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PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON.

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LIST

OF THE

OFFICERS AND COUNCIL

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON.

ELECTED JANUARY 11, 1884.

OFFICERS.

PRESIDENT.

CHARLES A. WHITE.

VICE PRESIDENTS.

WILLIAM H. DALL.
THEODORE GILL.
LESTER F. WARD.
CHARLES V. RILEY.

SECRETARIES.

G. BROWN GOODE.
RICHARD RATHBUN.

TREASURER.

TARLETON H. BEAN.

COUNCIL.

CHARLES A. WHITE, *President.*

TARLETON H. BEAN.
WILLIAM H. DALL.
THEODORE GILL.
G. BROWN GOODE.
OTIS T. MASON.
D. WEBSTER PRENTISS.
RICHARD RATHBUN.
CHARLES V. RILEY.
JOHN A. RYDER.
FREDERICK W. TRUE.
GEORGE VASEY.
LESTER F. WARD.

STANDING COMMITTEES.

COMMITTEE ON COMMUNICATIONS.

CHARLES V. RILEY, *Chairman.*

G. BROWN GOODE. RICHARD RATHBUN.

COMMITTEE ON PUBLICATIONS.

RICHARD RATHBUN, *Chairman.*

CHARLES V. RILEY. FRANK BAKER.

G. BROWN GOODE. J. W. CHICKERING, Jr.

WILLIAM S. BARNARD.

COMMITTEE ON LECTURES.

G. BROWN GOODE, *Chairman.*

OTIS T. MASON. RICHARD RATHBUN.

LESTER F. WARD. FREDERICK W. TRUE.

COMMITTEE ON THE TREES AND SHRUBS OF WASHINGTON.

LESTER F. WARD, *Chairman.*

EDWARD FOREMAN. WILLIAM SMITH.

FRANKLIN B. HOUGH. GEORGE VASEY.

LIST OF MEMBERS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON.

JANUARY 25, 1884.

HONORARY MEMBERS.

Date of Election.	
1881, Jan. 14.	BAIRD, SPENCER FULLERTON, M. D., LL. D., M. N. A. S., Secretary of the Smithsonian Institution and Director of the U. S. National Museum; U. S. Commissioner of Fish and Fisheries; Foreign Member of the Zoological and Linnean Societies of London. *Smithsonian Institution, and 1445 Massachusetts Avenue N. W.*

CORRESPONDING MEMBERS.

1882, Mar. 31.	AGASSIZ, ALEXANDER, A. B., S. B., M. N. A. S., Curator of the Museum of Comparative Zoology, Cambridge; Foreign Member of the Zoological and Linnean Societies of London. *Cambridge, Massachusetts.*
1882, Dec. 22.	ALLEN, HARRISON, M. D., Professor of Physiology in the University of Pennsylvania. *117 South Twentieth Street, Philadelphia, Pennsylvania.*
1882, April 8.	ALLEN, JOEL ASAPH, M. N. A. S., C. M. Z. S., Assistant in the Museum of Comparative Zoology, Cambridge; President of the American Ornithologists' Union; Editor of "The Auk." *Cambridge, Massachusetts.*
1882, April 28.	BREWER, WILLIAM HENRY, Ph. D., M. N. A. S., Professor of Agriculture in the Sheffield Scientific School, Yale College, New Haven. *New Haven, Connecticut.*
1881, Feb. 25.	BREWSTER, WILLIAM. *61 Sparks Street, Cambridge, Massachusetts.*
1881, Feb. 25.	BROOKS, WILLIAM KEITH, Ph. D., Associate Professor of Biology and Director of the Marine Laboratory of Johns Hopkins University, Baltimore. *Baltimore, Maryland.*

Date of Election.	CORRESPONDING MEMBERS—Continued.
1882, Jan. 6.	COLLETT, ROBERT, C. M. Z. S., Conservator of the Zoological Museum of the University of Christiania. *Christiania, Norway.*
1882, Dec. 22.	COPE, EDWARD DRINKER, M. A., M. N. A. S., C. M. Z. S., Editor of "The American Naturalist." *2100 Pine Street, Philadelphia, Pennsylvania.*
1881, April 14.	DERBY, ORVILLE ADELBERT, M. S., Curator of the Geological Section of the National Museum of Brazil. *Rio de Janeiro, Brazil.*
1882, Jan. 6.	FARLOW, WILLIAM GILSON, A. M., M. D., M. N. A. S., Professor of Cryptogamic Botany in Harvard University. *Cambridge, Massachusetts.*
1881, Mar. 11.	GIGLIOLI, ENRICO HILLYER, D. Sc., C. M. Z. S., Director of the Royal Zoological Museum of Vertebrates, and Professor of Vertebrate Zoology in the Royal Institute, Florence. *R. Istituto di Studi Superiori, Florence, Italy.*
1882, Jan. 6.	GRAY, ASA, M. D., LL. D., M. N. A. S., Fisher Professor of Natural History in Harvard University; Foreign Member of the Royal Society of London, and of the Institute of France. *Botanic Garden, Cambridge, Massachusetts.*
1884, Jan. 11.	HUBRECHT, A. A. W., C. M. Z. S., &c., Professor of Natural History in the University of Utrecht. *Utrecht, Holland.*
1882, Jan. 6.	HYATT, ALPHEUS, S. B., M. N. A. S., Professor of Zoology and Paleontology in the Massachusetts Institute of Technology; Custodian of the Boston Society of Natural History; President of the Society of Naturalists of the Eastern United States. *Cambridge, Massachusetts.*
1883, Jan. 5.	JORDAN, DAVID STARR, M. S., M. D., Professor of Natural History in Indiana State University. *Bloomington, Indiana.*
1881, April 8.	LAWRENCE, GEORGE N., C. M. Z. S. *45 East 21st St., New York City.*
1883, Dec. 14.	LYMAN, HON. THEODORE, A. M., M. N. A. S., Member of Congress from Massachusetts. *1407 Massachusetts Avenue N. W., Washington.*
1882, Dec. 22.	MARTIN, HENRY NEWELL, A. M., M. D., D. Sc., Professor of Biology in Johns Hopkins University. *Baltimore, Maryland.*
1882, Mar. 31.	MORSE, EDWARD S., Ph. D., M. N. A. S., Director of the Peabody Academy of Science, Salem. *Salem, Massachusetts.*

Date of Election.	CORRESPONDING MEMBERS—Continued.
1883, Nov. 30.	MOSELEY, HENRY NOTTIDGE, A. M., F. R. S., F. L. S., F. Z. S., &c., Linacre Professor of Human and Comparative Anatomy in the University of Oxford. *14, St. Giles, Oxford, England.*
1882, Mar. 31.	PACKARD, ALPHEUS SPRING, Jr., A. M., M. D., M. N. A. S., Professor of Zoology and Geology in Brown University, Providence; Editor of "The American Naturalist." *Providence, Rhode Island.*
1882, Dec. 22.	SCUDDER, SAMUEL HUBBARD, A. M., M. N. A. S., President of the Boston Society of Natural History; Editor of "Science." *Cambridge, Massachusetts.*
1882, Mar. 3.	SMITH, SIDNEY IRVING, Ph. B. Professor of Comparative Anatomy in Yale College, New Haven. *New Haven, Connecticut.*
1881, Feb. 25.	VELIE, JOHN W., M. D., Secretary and Curator of the Chicago Academy of Sciences. *263 Wabash Avenue, Chicago, Illinois.*
1882, Mar. 31.	VERRILL, ADDISON EMORY, A. M., S. B., M. N. A. S. Professor of Zoology and Curator of the Zoological Collections in Yale College, New Haven. *New Haven, Connecticut.*
1882, April 28.	WATSON, SERENO, Ph. D., M. N. A. S. Curator of the Herbarium of Harvard University. *Botanic Garden, Cambridge, Massachusetts.*
1882, Mar. 3.	WILSON, EDMUND BEECHER, Ph. D. Acting Professor of Natural History in Williams College. *Williamstown, Massachusetts.*

ACTIVE MEMBERS.*

1883, Jan. 19.	ACKER, GEORGE N., A. M., M. D., Demonstrator of Practical Physiology and Pathological Histology, National Medical College. *1403 New York Avenue N. W.*
1883, Dec. 28.	ACKERMAN, ALBERT AMMERMAN, Ensign, U. S. Navy, on duty on U. S. Fish Commission Steamer "Albatross." *Smithsonian Institution.*

*When not otherwise expressly stated, all addresses are in Washington. By the words "Original Member" are designated those who attended the meetings for organization, November 26 and December 3, 1880.

Date of Election.	ACTIVE MEMBERS—Continued.
1883, Jan. 19.	AMES, DELANO, Student. *1600 13th Street N. W.*
Orig. Member.	ASHFORD, FRANCIS ASBURY, M. D. Dean of Faculty and Professor of Surgery in the Medical Department of the University of Georgetown. **Died, 1883.**
1881, Jan. 14.	BAKER, FRANK, M. D., Professor of Anatomy in the Medical Department, University of Georgetown. *Office of Light House Board, and 326 C Street N. W.*
1882, Mar. 3.	BARKER, JOHN SHEPARD, Law Student. *715 H Street N. W.*
1881, Nov. 11.	BARNARD, WILLIAM STEBBINS, S. B., Ph. D. Assistant Entomologist, U. S. Department of Agriculture. *917 New York Avenue.*
Orig. Member.	BEAN, TARLETON HOFFMAN, M. D., M. S., Curator, Dep't of Fishes, U. S. National Museum. *National Museum, and 1404 S Street N. W.*
1883, Jan. 5.	BENEDICT, JAMES EVERARD, Naturalist of the U. S. Fish Commission Steamer "Albatross." *Smithsonian Institution, and 140 B Street N. E.*
1881, Mar. 25.	BESSELS, EMIL, M. D., Ph. D. *1444 N Street N. W.*
1881, Nov. 11.	BEYER, HENRY G., M. D., Passed Assistant Surgeon, U. S. Navy. *U. S. Steamer "Blake," Navy Yard, Brooklyn, New York.*
1884, Jan. 11.	BIGELOW, HORATIO RIPLEY, M. D. *1228 N Street N. W. (office), and 2 Iowa Circle.*
1883, Mar. 2.	BIGELOW, ROBERT PAYNE, Student. *1501 Eighteenth Street N. W., and Harvard University, Cambridge, Massachusetts.*
1882, Mar. 17.	BILLINGS, JOHN SHAW, A. M., M. D., Surgeon and Brevet Lieutenant Colonel, U. S. Army; Curator of the Army Medical Museum. *Army Medical Museum, and 3027 N Street N. W.*
1881, Jan. 14.	BIRNEY, HERMAN HOFFMAN, Student in Lehigh University. *1901 Harewood Avenue, Le Droit Park.*
1882, Jan. 20.	BIRNEY, GEN. WILLIAM, A. M. *1901 Harewood Avenue, Le Droit Park.*
1882, Feb. 17.	BLISH, JOHN BELL, Ensign, U. S. Navy. *Navy Department, Washington.*
1881, Nov. 11.	BRANSFORD, JOHN FRANCIS, M. D. Passed Assistant Surgeon, U. S. N. *Navy Department, Washington.*

Date of Election.	ACTIVE MEMBERS—Continued.
1882, Nov. 24.	BRITTON, WILEY, Agent, Quartermaster's Dept., U. S. Army. *Quartermaster General's Office, Washington.*
1883, Dec. 14.	BROMWELL, JOSIAH ROBSON, M. D. *1138 Connecticut Avenue, N. W.*
Orig. Member.	BROWN, JAMES TEMPLEMAN, Aid, U. S. National Museum. *National Museum, and 1607 Fifteenth Street N. W.*
Orig. Member.	BROWN, STEPHEN CARVOSSO, Registrar, U. S. National Museum. *National Museum, and 311 Eleventh Street S. W.*
1882, Nov. 24.	BROWNE, JOHN MILLS, M. D., Medical Director, U. S. N.; Curator of Naval Museum of Hygiene. *Bureau of Medicine and Surgery, U. S. Navy.*
1882, Dec. 22.	BRUNER, LAWRENCE, Assistant, Entomological Division, Department of Agriculture. *Department of Agriculture.*
1883, Dec. 28.	BRYAN, JOSEPH H., Passed Assistant Surgeon, U. S. Navy. *Museum of Hygiene, U. S. Navy.*
Orig. Member.	BURDICK, EDSON ALMERON. *Pension Office, and 406 Spruce Street N. W.*
1883, Jan. 5.	BURGESS, EDWARD SANDFORD, A. M., In charge of Department of Natural Science, Washington High School. *1214 K Street N. W.*
1882, Mar. 17.	BURNETT, SWAN MOSES, M. D., Professor of Clinical Ophthalmology and Otology, Medical Department, University of Georgetown. *1215 I Street N. W.*
Orig. Member.	BUSEY, SAMUEL CLAGETT, M. D., Emeritus Professor of the Theory and Practice of Medicine, Medical Department, University of Georgetown. *1525 I Street N. W.*
1881, June 3.	CANBY, WILLIAM JACKSON. *413 Tenth Street N. W.*
1881, June 3.	CARMAN, MYRON ALBERT, D. D. S. *New York City.*
1883, Jan. 19.	CHAPPEL, JOHN WILLIAM, M. D. *Tennallytown, D. C.*
1882, Feb. 17.	CHASE, HENRY SANDERS, Ensign, U. S. Navy, on duty in the National Museum. *Smithsonian Institution.*
1883, Apr. 27.	CHESTER, COLBY M., Commander, U. S. N.; Hydrographic Inspector, U. S. Coast and Geodetic Survey. *Coast Survey Office.*
Orig. Member.	CHICKERING, REV. JOHN WHITE, Jr., A. M., Professor of Natural Science in the National Deaf-Mute College. *Kendall Green, N. E.*

Date of Election.	ACTIVE MEMBERS—Continued.
1881, May 20.	CHICKERING, JOHN JAMESON, A. M., Teacher in the Public Schools. *Kendall Green, N. E.*
1882, Mar. 17.	CHRISTIE, ALEXANDER SMYTH, Astronomical Computer, U. S. Coast and Geodetic Survey. *Coast Survey Office, and 513 Sixth Street N. W.*
1881, Jan. 28.	CLARK, ALONZO HOWARD, Assistant, U. S. National Museum. *National Museum, and 1527 S Street N. W.*
1883, Dec. 14.	COLLINS, JOHN F. *Pension Office, and 1007 L Street N. W.*
1881, Feb. 23.	COLLINS, JOSEPH WILLIAM. *National Museum, and Gloucester, Massachusetts.*
Orig. Member.	COMSTOCK, JOHN HENRY, S. B., Professor of Entomology and General Invertebrate Zoology in Cornell University, Ithaca. *Ithaca, New York.*
1881, Dec. 23.	CONANT, WOODBURY PAGE, Assistant Botanist, Department of Agriculture. *Agricultural Department.*
Orig. Member.	COUES, ELLIOTT, A. M., M. D., Ph. D., M. N. A. S., C. M. Z. S., Professor of Anatomy, Medical Department, Columbian University. *Smithsonian Institution, and 1726 N Street N. W.*
1881, Nov. 11.	COX, WILLIAM VAN ZANT., A. B. *Smithsonian Institution.*
1881, Jan. 28.	DALL, WILLIAM HEALEY, Assistant, U. S. Coast and Geodetic Survey; Honorary Curator, Dept. of Mollusks, U. S. National Museum. *Coast Survey Office, and 1119 Twelfth Street N. W.*
1883, Feb. 3.	DAVIS, HARRY C., A. B., Professor of Greek, Wilkesbarre Academy. *248 Franklin Street, Wilkesbarre, Penn.*
1881, Nov. 11.	DEWEY, FREDERIC PERKINS, Ph. B., Curator, Dept. of Metallurgy, U. S. National Museum. *National Museum, and 920 N Street N. W.*
1881, Nov. 11.	DODGE, CHARLES RICHARDS, Special Agent, Tenth Census, Division of Fruit and Orchard Statistics. *1336 Vermont Avenue N. W.*
1882, Jan. 20.	DOSH, FRANK BOWMAN. **Died, 1883.**
1882, Dec. 22.	DRESEL, HERMAN GEORGE, Ensign, U. S. N., on duty in the National Museum. *Smithsonian Institution.*
1881, Jan. 28.	EARLL, ROBERT EDWARD, S. B. *Smithsonian Institution.*
1881, Feb. 25.	ELLIOTT, HENRY WOOD. *Smithsonian Institution, and Cleveland, Ohio.*

Date of Election.	ACTIVE MEMBERS—Continued.
1881, Nov. 25.	ELLZEY, MASON GRAHAM, A. M., M. D., Lecturer on Hygiene and Medical Jurisprudence, Medical Department, University of Georgetown. *1012 I Street N. W.*
1882, Oct. 27.	ENTHOFFER, JOSEPH, U. S. Coast Survey. *68 I Street N. W.*
1883, May 11.	FALLS, MOOR S., Medical Student. *1200 Eighteenth Street N. W.*
1881, Jan. 28.	FERGUSON, THOMAS BARKER, Assistant Commissioner of Fisheries. *1435 Massachusetts Avenue N. W.*
1881, Mar. 25.	FLETCHER, ROBERT, M. D., Acting Assistant Surgeon, U. S. Army; Editor of "Index Medicus." *Surgeon General's Office, and 1326 L Street N. W.*
1881, Feb. 11.	FLINT, JAMES MILTON, M. D., Surgeon, U. S. Navy; Honorary Curator, Section of Materia Medica, U. S. National Museum. *National Museum, and Riggs House.*
1881, Dec. 9.	FOREMAN, EDWARD, M. D., Assistant, U. S. National Museum. *National Museum, and 200 Eleventh Street S. W.*
1883, Apr. 13.	FOSTER, RICHARD, B. S., Instructor of Natural History in Howard University. *Howard University.*
1883, Apr. 27.	FOX, WILLIAM HENRY. *1828 H Street N. W.*
1883, Dec. 14.	FRANZONI, CHARLES WILLIAM, Ph. B., M. D. *810 H Street N. W.*
1883, Mar. 30.	FRIEDRICH, LEON L., M. D., Prosector to the Chair of Anatomy, National Medical College. *323 East Capitol Street.*
1883, Jan. 5.	FRISTOE, EDWARD T., A. M., LL. D., Professor of Chemistry in Columbian University and National Medical College. *1434 N Street.*
1881, Mar. 25.	GANNETT, HENRY, S. B., A.Met.B., Chief Geographer of the U. S. Geological Survey. *Office of Geological Survey, and 1881 Harewood Ave., Le Droit Park.*
1882, Feb. 17.	GARRETT, LEROY MASON, Ensign, U. S. Navy, on duty on Steamer "Albatross." *Smithsonian Institution.*
Orig. Member.	GEDNEY, CHARLES DEFOREST. *Coast Survey Office, and 115 F Street N. E.*
1881, Mar. 11.	GIHON, ALBERT LEARY, A. M., M. D., Medical Director, U. S. Navy. In charge of the U. S. Naval Hospital, Washington, D. C. *2019 Hillyer Place N. W.*

Date of Election.	ACTIVE MEMBERS—Continued.
1882, April 28.	GILBERT, GROVE KARL, M. N. A. S., Geologist, U. S. Geological Survey. *May Building, and 1424 Corcoran Street N. W.*
Orig. Member.	GILL, THEODORE NICHOLAS, M. D., Ph. D., M. N. A. S. *Cosmos Club, and 321 Four-and-a-half Street.*
1883, Mar. 30.	GILPIN, GEORGE E., M. D. *Tennallytown, D. C.*
1882, Nov. 24.	GODWIN, HARRY P., Journalist. *Office of "Evening Star," and 15 Second Street S. E.*
Orig. Member.	GOODE, GEORGE BROWN, A. M., Assistant Director of the U. S. National Museum. *Smithsonian Institution, and 1620 Massachusetts Avenue N. W.*
1882, Oct. 27.	GOODRICH, JOSEPH KING, Assistant, U. S. National Museum. *National Museum.*
Orig. Member.	GORE, JAMES HOWARD, S. B., Professor of Mathematics in Columbian University; Astronomer, U. S. Geological Survey. *Columbian University, and 1305 Q Street N. W.*
1881, Nov. 11.	GRIFFITH, SAMUEL HENDERSON, M. D., Passed Assistant Surgeon, U. S. Navy. *Bureau of Medicine, U. S. Navy.*
1882, Nov. 24.	GURLEY, REVERE R. *Children's Hospital.*
1883, Dec. 14.	HAGNER, CHARLES E., M. D. *1400 H Street N. W.*
1882, Nov. 24.	HAMILTON, JOHN B., M. D., Supervising Surgeon General, U. S. Marine Hospital Service. *9 B Street N. W.*
Orig. Member.	HASSLER, FERDINAND AUGUSTUS, M. D. *Tustin City, Los Angeles Co., California.*
1881, Feb. 25.	HAWES, GEORGE WESSON, Ph. D. **Died, 1882.**
1882, Feb. 3.	HAWKES, WILLIAM HIMES, A. B., M. D. *1330 New York Avenue.*
1882, Feb. 17.	HAYDEN, EDWARD EVERETT, Ensign U. S. Navy, on duty at the National Museum. *Smithsonian Institution.*
1882, Mar. 31.	HENSHAW, HENRY WETHERBEE, Ethnologist, Bureau of Ethnology, Smithsonian Institution. *1114 M Street N. W.*
1881, Jan. 14.	HESSEL, RUDOLPH, Ph. D., Superintendent of Government Carp Ponds. *514 Tenth Street N. W.*
1883, Feb. 16.	HICKLING, DANIEL PERCY. *301 Pennsylvania Avenue N. W.*

Date of Election.	ACTIVE MEMBERS—Continued.
1883, Feb. 16.	Hickling, Daniel Percy, Jr., Student. *301 Pennsylvania Avenue N. W.*
1883, Nov. 16.	Hitchcock, Romyn, F. R. M. S., Assistant, U. S. National Museum; Editor of "American Monthly Microscopical Journal." *1316 Tenth Street N. W.*
1882, Dec. 22.	Hoadly, Frederick H., M. D. *New Haven, Connecticut.*
Orig. Member.	Hoffman, Walter James, M. D., Assistant Ethnologist, Bureau of Ethnology, Smithsonian Institution. *222 E Street N. W.*
1882, April 14.	Hornaday, William Tell, Chief Taxidermist U. S. National Museum. *National Museum, and 404 Spruce Street, Le Droit Park.*
1882, May 26.	Hough, Franklin Benjamin, A. M., M. D., Ph. D., Statistician. *Lowville, N. Y.*
1882, April 27.	Hough, Myron Beach Warner. *U. S. Treasurer's Office, and 312 Indiana Avenue N. W.*
Orig. Member.	Howard, Leland O., M. S., Assistant, Entomological Division, U. S. Department of Agriculture. *Agricultural Department, and 1407 Fifteenth Street N. W.*
1883, Feb. 6.	Howe, Frank T., M. D., City Editor "National Republican." *Office of "Republican," and 1434 Corcoran Street N. W.*
1881, Feb. 25.	Howland, Edwin Perry, M. D. *211 Four-and-a-half Street N. W.*
Orig. Member.	Ingersoll, Ernest. *New Haven, Connecticut.*
1882, Dec. 22.	Israel, George Robert, A. B., LL. B., Teacher in Washington High School. *903 New York Avenue N. W.*
1882, Mar. 3.	Johnson, Arnold Burges, A. M., Chief Clerk, U. S. Light House Board. *501 Maple Avenue, Le Droit Park.*
1882, Jan. 20.	Johnson, Blanchard Freeman, Student. *501 Maple Avenue, Le Droit Park.*
1882, Feb. 3.	Johnson, Joseph Taber, A. M., M. D., Professor of Obstetrics and Diseases of Women and Infants, Medical Department of the University of Georgetown; Gynecologist to Providence Hospital. *926 Seventeenth Street N. W.*
1882, Nov. 24.	Johnston, William Waring, M. D., Professor of the Theory and Practice of Medicine, National Medical College. *1603 K Street N. W.*

Date of Election.	ACTIVE MEMBERS—Continued.
1883, Mar. 2.	JONES, HENRY ALEXANDER, Inspector of Fuel for the District of Columbia. *1004 N Street N. W.*
Orig. Member.	JOUY, PIERRE LOUIS, Attaché of the Corean Embassy. *Seôul, Corea.*
1882, Oct. 27.	KELLY, THOMAS. *Absent from the city.*
Orig. Member.	KIDDER, JEROME HENRY, A. M., M. D., Surgeon, U. S. Navy. Chemist, U. S. Fish Commission. *Smithsonian Institution and 1816 N Street N. W.*
Orig. Member.	KING, ALBERT FREEMAN AFRICANUS, M. D., Professor of Obstetrics and Diseases of Women and Children, Medical Department, Columbian University. President of the Medical Society of the District of Columbia. *726 Thirteenth Street N. W.*
1881, Nov. 25.	KOEBELE, ALBERT. *Entomological Division, Department of Agriculture.*
Orig. Member.	LEE, WILLIAM, M. D., Professor of Physiology in the Medical Department of Columbian University. *2111 Pennsylvania Avenue N. W.*
1882, Mar. 17.	LEECH, DANIEL, Corresponding Clerk, Smithsonian Institution. *1507 Vermont Avenue N. W.*
1882, Jan. 20.	LEHNERT, REV. ERNEST, Pastor of St. John's Lutheran Church. *325 Four-and-a-half Street.*
1882, Oct. 27.	LUCAS, FREDERIC AUGUSTUS, Osteologist, U. S. National Museum.
1882, Dec. 22.	MCARDLE, THOMAS EUGENE, A. M., M. D., Secretary of the Medical Society of the District of Columbia. *707 Twelfth Street N. W.*
1883, Dec. 28.	MCCLAIN, CHARLES SUMNER, Ensign, U. S. Navy, on duty in the U. S. National Museum. *Smithsonian Institution.*
1883, Apr. 27.	MCCONNELL, JAMES CULBERTSON, M. D., Army Medical Museum. *425 M Street N. W.*
1881, Jan. 28.	MCDONALD, MARSHALL, Chief of Division of Distribution, U. S. Fish Commission; Commissioner of Fisheries for the State of Virginia. *1136 Twelfth Street N. W.*
1883, Apr. 13.	MCELHONE, JAMES FRANCIS, Student in Georgetown University. *1318 Vermont Avenue.*

Date of Election.	ACTIVE MEMBERS—Continued.
1883, Dec. 14.	McGee, W. J., Assistant, U. S. Geological Survey. *512 Thirteenth Street N. W.*
1881, May 20.	McMurtrie, William, E. M., M. S., Ph. D., Professor of Chemistry in Illinois Industrial University. *Champaign, Illinois.*
1881, Nov. 11.	Mann, Benjamin Pickman, A. B., Assistant, Entomological Division, U. S. Department of Agriculture; Editor of "Psyche." *Agricultural Department, and 924 Nineteenth Street N. W.*
1883, Nov. 3.	Marcou, John Belknap, Assistant, U. S. Geological Survey. *National Museum, and 1319 Eleventh Street N. W.*
1882, Feb. 17.	Marsh, Charles Carrolton, Ensign U. S. Navy, on duty in the National Museum. *Smithsonian Institution.*
1882, Jan. 20.	Martin, Frank. *1835 G Street N. W.*
Orig. Member.	Marx, George, Zoological Draughtsman, U. S. Department of Agriculture. *Agricultural Department, and 1626 Fourteenth Street N. W.*
Orig. Member.	Mason, Otis Tufton, A. M., Ph. D., Principal of the Columbian University Preparatory School. *1305 Q Street N. W.*
1881, Jan. 28.	Merrill, George Perkins, M. S., Acting Curator, Department of Lithology, U. S. National Museum. *National Museum, and 1221 M Street N. W.*
1881, June 3.	Miller, Benjamin. *1516 Thirty-first Street N. W.*
1882, Feb. 17.	Miner, Randolph Huntington, Ensign U. S. Navy, on duty on Steamer "Albatross." *Smithsonian Institution.*
1883, Nov. 30.	Murdoch, John, A. M., Naturalist and Observer, Point Barrow Expedition, on duty at Smithsonian Institution. *Smithsonian Institution.*
1881, Dec. 9.	Nelson, Edward W. *Colorado Springs, Colorado.*
1883, Feb. 2.	Nelson, Henry Clay, M. D. Medical Inspector, U. S. Navy. *Navy Department.*
1882, Dec. 22.	Netto, Senhor Felippe Lopes. Brazilian Minister. *1710 Pennsylvania Avenue.*
1883, Jan. 19.	Niblack, Albert Parker. Ensign, United States Navy, on duty in the National Museum. *Smithsonian Institution.*

Date of Election.	ACTIVE MEMBERS—Continued.
Orig. Member.	NORRIS, BASIL, M. D., Surgeon and Brevet Colonel, U. S. Army. *1829 G Street N. W.*
1882, Nov. 24.	OURT, A. J., M. D. *Absent from the city.*
1883, Mar. 2.	PALMER, WILLIAM GRAY, M. D. *929 H Street N. W.*
1882, Dec. 22.	PARKER, PETER, JR. Aid, U. S. National Museum. *2 Lafayette Square N. W.*
1883, April 13.	PARSON, REV. WILLIAM EDWIN, A. M., Pastor of the Church of the Reformation. *309 New Jersey Avenue S. E.*
1882, Dec. 22.	PATTON, HORACE B., A. B., Student. *Leipzig, Germany.*
Orig. Member.	PATTON, WILLIAM HAMPTON, A. B. *New York City.*
Orig. Member.	PERGANDE, THEODORE, Assistant, Entomological Division, U. S. Department of Agriculture. *321 D Street N. W.*
1883, Feb. 16.	PERSONS, REMUS CHARLES, A. M., M. D., Surgeon, U. S. Navy. *U. S. Steamer Wyandotte, Navy Yard, Washington.*
1883, Nov. 16.	PHILLIPS, LOUIS E., Law Student. *1428 New York Avenue N. W.*
Orig. Member.	PORTER, JOHN HAMPDEN, M. D. *2720 M Street N. W.*
1882, Dec. 22.	POTTER, ZIBA H., M. D., Medical Examiner, U. S. Pension Office. *Pension Office, and 1609 Nineteenth Street N. W.*
1881, Feb. 11.	POWELL, JOHN WESLEY, Ph. D., LL. D., M. N. A. S., Director, U. S. Geological Survey, and Director, Bureau of Ethnology, Smithsonian Institution; President of the Anthropological Society of Washington. *National Museum, and 910 M Street N. W.*
Orig. Member.	PRENTISS, DANIEL WEBSTER, Ph. B., A. M., M. D., Professor of Materia Medica and Therapeutics, Medical Department, Columbian University; Commissioner of Pharmacy, District of Columbia. *1224 Ninth Street N. W.*
Orig. Member.	RATHBUN, RICHARD, M. S., Curator, Dep't of Marine Invertebrates, U. S. National Museum. *Smithsonian Institution, and 1622 Massachusetts Avenue N. W.*
1881, May 20.	RAU, CHARLES, Ph. D., Curator, Dep't of Antiquities, U. S. National Museum. *Smithsonian Institution.*
1881, Dec. 9.	REYBURN, ROBERT, A. M., M. D., Professor of Physiology and Hygiene, Medical Department, Howard University. *2129 F Street N. W.*

Date of Election.	ACTIVE MEMBERS—Continued.
1882, Oct. 27.	RHEES, WILLIAM JONES., A. M., Chief Clerk, Smithsonian Institution. *Smithsonian Institution, and "The Oaks," Spring Road, near Fourteenth Street, Mt. Pleasant, D. C.*
1882, Mar. 17.	RICHEY, STEPHEN OLIN, M. D. *1426 New York Avenue.*
Orig. Member.	RIDGWAY, ROBERT, C. M. Z. S., Curator, Dep't of Birds, U. S. National Museum. *Smithsonian Institution, and 1214 Virginia Avenue S. W.*
Orig. Member.	RILEY, CHARLES VALENTINE, A. M., Ph. D., Entomologist, U. S. Department of Agriculture; Honorary Curator of Insects, U. S. National Museum. *Agricultural Department, and 1700 Thirteenth Street N. W.*
1882, April 28.	RUSSELL, ISRAEL COOK, Assistant Geologist, U. S. Geological Survey. *1424 Corcoran Street.*
1882, Mar. 31.	RYDER, JOHN ADAM, Embryologist, U. S. Fish Commission. *Smithsonian Institution.*
1882, Nov. 24.	SAFFORD, WILLIAM EDWIN, Ensign, U. S. Navy, on duty at National Museum. *Peabody Museum of Yale College, New Haven, Connecticut.*
1883, May 25.	SALMON, DANIEL ELMER, D. V. M., Veterinarian, U. S. Department of Agriculture. *1221 I Street N. W.*
Orig. Member.	SCHÆFFER, EDWARD MARTIN, M. D., Lecturer on the Microscope and Microscopical Anatomy, Medical Department, University of Georgetown. *1321 F Street N. W.*
1882, Jan. 20.	SCHÖNBORN, HENRY. *213 Seventh Street N. W.*
1882, Mar. 11.	SCHUERMANN, CARL WILHELM, Property Clerk, U. S. National Museum. *916 D Street S. W.*
Orig. Member.	SCHWARZ, EUGENE AMANDUS, Assistant in the Entomological Division, U. S. Department of Agriculture. *949 Virginia Avenue S. W.*
1881, Jan. 14.	SCUDDER, CHARLES WILLIS, Clerk, U. S. Fish Commission. *939 C Street S. W.*
Orig. Member.	SCUDDER, NEWTON PRATT, A. M., Clerk, Smithsonian Institution. *939 C Street S. W.*
Orig. Member.	SEAMAN, WILLIAM HENRY, M. D., B. L., Professor of Chemistry, in the Medical Department of Howard University. *1424 Eleventh Street N. W.*

Date of Election.	ACTIVE MEMBERS—Continued.
1882, May 26.	SEATON, CHARLES W., Superintendent of the Tenth Census. *Census Office, and 242 North Capitol Street N. W.*
Orig. Member.	SHELDON, CHARLES STILES. *Absent from the city.*
1881, Nov. 11.	SHUFELDT, ROBERT WILSON, M. D., Captain, Medical Corps, U. S. Army, in charge of Section of Comparative Anatomy, Museum and Library, Surgeon General's Office, War Department. *2125 L Street N. W.*
1882, Feb. 17.	SHUTE, DANIEL KERFOOT, A. B., M. D. *Washington Asylum Hospital.*
Orig. Member.	SMILEY, CHARLES WESLEY, A. M., Chief of Division of Records, and Editor of the Bulletin of the U. S. Fish Commission. *Fish Commission Office, and 1207 Eleventh Street N. W.*
1883, Mar 2.	SMILLIE, THOMAS WILLIAM, Photographer, U. S. National Museum. *National Museum.*
1883, Feb. 16.	SMITH, THOMAS CROGGON, M. D. *1133 Twelfth Street N. W.*
1881, Nov. 11.	SMITH, WILLIAM ROBERT, Superintendent of U. S. Botanical Garden. *Botanical Garden.*
1882, Jan. 6.	SPERR, FREDERICK W. *Absent from the city.*
1881, Nov. 11.	STEJNEGER, LEONHARD. *Smithsonian Institution.*
1881, Mar. 25.	STERNBERG, GEORGE MILLER, M. D., Surgeon, U. S. Army. *Fort Mason, San Francisco, Cal.*
1882, Mar. 17.	STEVENSON, JAMES, Executive Officer of the U. S. Geological Survey. *National Museum.*
1883, Dec. 14.	STEWART, ALONZO HOPKINS. *204 Fourth Street S. E.*
1881, Feb. 25.	STIMPSON, WILLIAM GORDON, Aid, U. S. National Museum. *1447 Q Street N. W.*
1882, Feb. 17.	STREETS, THOMAS HALE, M. D., Passed Assistant Surgeon, U. S. Navy. *Bureau of Medicine and Surgery, U. S. Navy, and 2021 N Street N. W.*
1882, Nov. 24.	TARR, RALPH STOCKMAN. *45 Warren Street, Gloucester, Massachusetts.*
1882, Mar. 17.	TAYLOR, FREDERICK WILLIAM, Chemist, U. S. National Museum. *National Museum, and 1120 Vermont Avenue N. W.*

ACTIVE MEMBERS—Continued.

Date of Election.	
1882, Dec. 22.	TAYLOR, JAMES HEMPHILL, Lawyer. *482 Louisiana Avenue N. W.*
Orig. Member.	TAYLOR, THOMAS, M. D., Microscopist, U. S. Department of Agriculture. *Agricultural Department, and 238 Massachusetts Avenue N. E.*
1882, Oct. 27.	TAYLOR, WILLIAM BOWER, A. M., Editor, Smithsonian Institution. *306 C Street N. W.*
1883, Jan. 5.	THOMAS, CYRUS, Ph. D., Ethnologist, Bureau of Ethnology of the Smithsonian Institution. *1246 Eleventh Street N. W.*
1881, Dec. 9.	THOMPSON, JOHN FORD, M. D., Professor of Surgery, Medical Department, Columbian University. *1401 H Street N. W.*
1881, Jan. 28.	TODD, JAMES EDWARD, A. M., Professor of Natural Sciences in Tabor College; Assistant Geologist, U. S. Geological Survey. *Tabor, Iowa.*
Orig. Member.	TONER, JOSEPH MEREDITH, M. D. *615 Louisiana Avenue N. W.*
Orig. Member.	TRUE, FREDERICK WILLIAM, M. S., Librarian, and Curator, Dep't of Mammals, U. S. National Museum. *National Museum.*
1883, Nov. 30.	TUPPER, JAMES BRAINERD TAYLOR, A. M. *Internal Revenue Bureau, Treasury Department, and 510 I Street N. W.*
1882, Oct. 27.	TURNER, HENRY W., Assistant Geologist, U. S. Geological Survey. *San Francisco, California.*
1881, Dec. 23.	TURNER, LUCIEN M., Observer, U. S. Signal Service. *Ungava, Labrador.*
Orig. Member.	ULKE, HENRY. *411 Fifteenth Street N. W.*
1881, Mar. 25.	UPHAM, EDWIN PORTER, Aid, U. S. National Museum. *Smithsonian Institution, and 2010 Thirteenth Street N. W.*
Orig. Member.	VASEY, GEORGE, M. D., Botanist, U. S. Department of Agriculture. *Agricultural Department, and 2012 Fourteenth Street N. W.*
1883, Nov. 3.	WALCOTT, CHARLES DOOLITTLE, Paleontologist, U. S. Geological Survey. *Smithsonian Institution, and 810 Twelfth Street N. W.*

Date of Election.	ACTIVE MEMBERS—Continued.
Orig. Member.	WARD, LESTER FRANK, A. M., LL. B., Geologist, U. S. Geological Survey; Honorary Curator, Dep't of Fossil Plants, U. S. National Museum. *National Museum, and 1464 Rhode Island Avenue N. W.*
1882, Nov. 24.	WELD, GEORGE FRANCIS, Student. *Smithsonian Institution, and 1600 Thirteenth Street.*
1882, Dec. 22.	WEST, HENRY LITCHFIELD, City Editor, "Washington Post." *Office of the "Post," and 111 E Street N. W.*
Orig. Member.	WHITE, CHARLES ABIATHAR, A. M., M. D., Curator Dep't of Fossil Invertebrates, U. S. National Museum; Paleontologist, U. S. Geological Survey. *National Museum, and 409 Maple Avenue, Le Droit Park.*
1883, Dec. 14.	WHITE, CHARLES HENRY, M. D., Surgeon, U. S. Navy. *Museum of Hygiene, Navy Department.*
1881, May 20.	WHITE, MAURICE PUTNAM, Teacher, Public School, Boston, Massachusetts. *523 Columbus Avenue, Boston.*
1881, Jan. 28.	WILLIAMS, ALFRED. *Department of State, and 232 North Capitol Street N. W.*
1883, Feb. 16.	WILSON, JAMES ORMOND, Superintendent of Public Schools, District of Columbia. *1439 Massachusetts Avenue.*
Orig. Member.	WILSON, JOSEPH MCMINN. *Department of the Interior, and 1108 Maryland Avenue S. W.*
1881, Dec. 9.	WINSLOW, FRANCIS, Lieutenant U. S. Navy, on duty with U. S. Fish Commission. *1446 N Street N. W.*
1881, Jan. 28.	WOLFLEY, WILLIAM IRVIN, A. M., M. D. *140 C Street N. E.*
1882, Feb. 17.	YARNALL, JOHN HEPBURN, M D. *3028 P Street N. W.*
Orig. Member.	YARROW, HENRY CRÉCY, M. D., C. M. Z. S., Acting Assistant Surgeon, U. S. Army; Hon. Curator, Dep't of Reptiles, U. S. National Museum. *Surgeon General's Office, and 814 Seventeenth Street N. W.*
1882, Oct. 28.	YARROW, JOHN, Aid, U. S. National Museum. *814 Seventeenth Street, N. W.*
1881, Feb. 25.	YEATES, WILLIAM SMITH, A. M., Aid, U. S. National Museum. *National Museum, and 401 G Street N. W.*
1882, Jan. 6.	ZUMBROCK, ANTON, M. D., Electrotyper and Photographer, U. S. Coast and Geodetic Survey. *Coast Survey Office.*

ADDITIONAL LIST OF MEMBERS,

CORRECTED TO JULY 1, 1884.

CORRESPONDING MEMBERS.

Date of Election.	
1884, Feb. 8	FLOWER, WILLIAM HENRY, LL. D., F. R. S., Pres. Z. S., F. L. S.; Director of the Natural History Departments of the British Museum. *South Kensington, London, S. W.*
1884, Feb. 8	HORN, GEORGE HENRY, M. D.; Pres. American Entomological Society. *874 North Fourth Street, Philadelphia, Pennsylvania.*
1884, Feb. 8	MARSH, OTHNIEL CHARLES, M. A., Pres. N. A. S.; Professor of Palæontology in Yale College, and Palæontologist to the U. S. Geological Survey. *New Haven, Connecticut.*

ACTIVE MEMBERS.

1884, April 19	BATES, HENRY HOBART, Examiner in Chief, U. S. Patent Office. *U. S. Patent Office, and "The Portland."*
1884, Mar. 22	BECKHAM, CHARLES WICKLIFFE, Aid, Department of Birds, U. S. National Museum. *Smithsonian Institution, and 1315 Connecticut Avenue.*
1884, Mar. 22	BENDIRE, CHARLES, Captain 1st Cavalry, U. S. A.; Honorary Curator, Section of Oology, U. S. National Museum. *Fort Custer, Montana Territory.*
1884, Feb. 8	DILLER, JOSEPH SILAS, S. B., Assistant Geologist, U. S. Geological Survey. *1804 Sixteenth Street N. W.*
1884, May 17	EGGLESTON, NATHANIEL HILLYER, Chief of Bureau of Forestry, U. S. Department of Agriculture. *Agricultural Department, and 1302 L Street N. W.*
1884, May 3	GEARE, RANDOLPH ILTYD. *U. S. National Museum, and 803 T Street N. W.*
1884, Feb. 23	JOHNSON, WILLARD DRAKE, Topographer, U. S. Geological Survey. *Washington, D. C., and Worcester, Massachusetts.*
1884, Mar. 22	KNAPP, E. B. *Skaneateles, New York.*

Date of Election. ACTIVE MEMBERS—Continued.

1884, April 5 | Moser, Jefferson Franklin, Lieutenant, U. S. N.; Assistant Hydrographic Inspector, U. S. Coast and Geodetic Survey. *Coast Survey Office, and 7 Second Street S. E.*

1884, April 19 | Nichols, Henry E., Lieutenant Commander, U. S. Navy, commanding U. S. S. Pinta. *Sitka, Alaska.*

1884, May 3 | Sayles, Ira, Geologist, U. S. Geological Survey. *511 F Street N. W.*

1884, Feb. 8 | Smith, Theobald, Ph. B., M. D., Assistant, Bureau of Animal Industry, U. S. Department of Agriculture. *Agricultural Department, and 917 New York Avenue N. W.*

1884, Mar. 22 | Wilson, Hon. William Lyne, Member of Congress from West Virginia. *1008 N Street N. W.*

1884, April 19 | Wortman, Jacob L., Osteologist, Army Medical Museum. *628 Penn. Ave. N. W.*

THE BIOLOGICAL SOCIETY OF WASHINGTON.

CONSTITUTION.

Adopted December 3, 1880.

ARTICLE I.

NAME.

The name of this Society shall be "THE BIOLOGICAL SOCIETY OF WASHINGTON."

ARTICLE II.

OBJECTS.

Its objects shall be to encourage the study of the Biological Sciences, and to hold meetings at which papers shall be read and discussed.

ARTICLE III.

MEMBERS.

The Society shall consist of active, corresponding and honorary members. Candidates for membership shall be proposed to the Council, in writing, by at least three members, and, upon recommendation of the majority of the Council present at its regular meeting, shall be balloted for at the earliest ensuing meeting. A majority vote of the members present when the ballot is taken shall be necessary to election.

ARTICLE IV.

OFFICERS.

The officers shall be a President, four Vice-Presidents, two Secretaries, and a Treasurer. There shall be a Council, consisting of the officers of the Society and five members, to be elected by the Society. A quorum of the council shall consist of seven members.

Its duties shall be to act on nominations for membership, have the direction of the finances, audit the accounts of the Treasurer, and provide a programme for each meeting of the Society.

The officers shall be elected by ballot at each annual meeting, and shall serve one year, or until their successors are elected.

ARTICLE V.

PRESIDENT AND VICE-PRESIDENTS.

The President, or, in his absence, one of the Vice Presidents, shall preside at meetings of the Society and Council. The presiding officer shall appoint all committees in the Council and in the Society, unless otherwise ordered. It shall be the duty of the retiring President to deliver an address at the second meeting in January.

ARTICLE VI.

SECRETARIES.

The Secretaries shall take and preserve correct minutes of the proceedings of the Society and Council and a record of the members, shall conduct its correspondence, give due notice of all meetings, and inspect and count all ballots.

ARTICLE VII.

TREASURER.

The Treasurer shall have charge of all money and other property of the Society, and shall make disbursements under the direction of the Council. He shall collect all fees and assessments, and notify members who may be in arrears.

ARTICLE VIII.

SECTIONS.

Sections for special work in any department of Biology may be formed upon the recommendation of the Council.

ARTICLE IX.

MEETINGS.

Stated meetings shall, unless otherwise ordered, be held on Friday of each alternate week, at eight o'clock P. M. The annual meeting

for the election of officers shall be the first meeting in January. Special and field meetings may be called by the Council.

ARTICLE X.

As amended February 2, 1883.

FEES.

The initiation fee shall be one dollar; the annual fee two dollars. Members in arrears for one year shall, after due notification by the Treasurer, be dropped from the rolls, except in the case of those absent from the city for a year or more, who may be retained on the list as non-resident members during their absence. No member in arrears shall be entitled to vote at the annual meeting for the election of officers.

ARTICLE XI.

AMENDMENTS TO THE CONSTITUTION.

The constitution of the Society may be amended by a two-thirds vote of the members present at any regular meeting, after at least four weeks' notice.

ARTICLE XII.

ORDER OF BUSINESS.

The order of business at each regular meeting, unless otherwise provided by the Council, shall be as follows:

I. Reading of minutes.
II. Reports of Committees.
III. Balloting for members.
IV. Nominations for membership.
V. Miscellaneous business.
VI. Reading of papers, discussions and exhibition of specimens.

Article XII may be suspended at any time by a two-thirds vote of the members present.

PROCEEDINGS.

THIRTY-SECOND MEETING, October 13, 1882.

The President occupied the chair. Thirty-two members were present. Both secretaries being absent, Dr. Tarleton H. Bean was designated Secretary *pro tempore*.

General William Birney, Chairman of the Committee on the Admission of Women to Membership in the Society, submitted a report in the form of the following resolution :

"*Resolved*, In view of the fact that this Society has not prescribed scientific attainments as a qualification for membership, it is inexpedient at present to declare women eligible; but, if it should hereafter prescribe such qualifications, there is no sufficient reason for their exclusion."

On motion of Prof. Riley, the report was adopted and the Committee discharged.

Mr. Frederick W. True read a paper ON THE BITE OF THE CORAL SNAKE,* describing the effects of the attack of one of the specimens in the National Museum upon Mr. A. Z. Shindler, one of the artists in the Museum, and citing the testimony of several correspondents in the southwestern United States. Remarks were made by Professors Ward and Gill. Prof. Theodore Gill read a paper entitled THE RELATIONS OF THE ECHENEIDIDS,† demonstrating the claims of this group of fishes to isolation, not only as a family, but as a suborder, related rather more closely to the Gobioidea and Blennioidea than to the Scombroidea. He characterized the suborder *Discocephali*, and the family *Echeneididæ* and sub-family *Echineidinæ*, and gave a detailed history of the views of ichthyological writers from Artedi to Cope.

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* 1883. TRUE, FREDERICK W. On the Bite of the North American Coral Snakes (Genus Elaps). <American Naturalist, 1883, pp. 26–31.

† 1883. GILL, THEODORE. Note on the Relationships of the Echeneidids, <Proceedings U. S. National Museum, V, pp. 561–6, Plate XII, 1883.

Mr. Wm. H. Dall made some remarks on CLUSTER FLIES,* exhibiting specimens of *Musca rudis* from Geneva, N. Y., where, for thirty years or more, this fly has been regarded as a household pest in the spring and fall, when it gathers in swarms in the corners of apartments in country houses.

THIRTY-THIRD MEETING, October 27, 1882.

The President occupied the chair. Thirty-eight members were present.

The President announced the presentation to the Society by Dr. John J. Mason of his work entitled MINUTE STRUCTURE OF THE CENTRAL NERVOUS SYSTEM OF CERTAIN REPTILES AND BATRACHIANS OF AMERICA.

Mr. Goode, on behalf of the Council, announced his intention of proposing at the second meeting from date, the following amendment to the Constitution:

Section X to be amended so as to read, "Members in arrears for one year shall, after due notification by the Treasurer, be dropped from the rolls, except in the case of those absent from the city for one year or more, who may be retained on the list as non-resident members during their absence." †

A committee, consisting of Messrs. Goode, Gill, Mason, Ward, True, and Rathbun, was appointed to arrange for courses of lectures, similar to the Saturday lectures of the previous season.

Mr. Wm. H. Dall made a few remarks in extension of his paper on the "Cluster Fly," presented at the previous meeting, and read a letter from Professor C. V. Riley in relation to its name and geographical distribution.*

Dr. W. S. Barnard made a communication upon the subject of ECTOPARASITIC TREMATODES, describing two species believed to be new, for which, however, no names were proposed.

Mr. W. P. Conant made some remarks upon TWO CASES OF SNAKE BITE IN MASSACHUSETTS, relating instances in which the bites of unknown species of snakes had been attended by very serious results.

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* 1883. DALL, W. H. Note on Cluster Flies. Proceedings U. S. National Museum, V, pp. 635–7, 1883. Includes a letter from C. V. Riley.

† This amendment was adopted at the meeting of February 2, 1883.

Mr. Frederick W. True read a paper On the Cinnamon Bear,* exhibiting a specimen recently received by the National Museum from Lycoming county, Pennsylvania. He quoted the opinions of several authorities as to the relationship of this form to the black bear, but did not express a decided personal opinion. He also exhibited the skin of a young black bear from Alaska, with a broad white ring around the neck.

Thirty-Fourth Meeting, November 10, 1882.

The President occupied the chair. Forty-two members were present.

Mr. True announced that he had in preparation a paper on the mammals of the District of Columbia, and requested information concerning rare forms and concerning the dates when deer and other mammals became extinct in the District.

Professor Chickering read a paper on The "Balds" of the Southern Mountains.

Dr. George Vasey made a communication on the Pine Trees of North America, which was discussed by Mr. Dall, Dr. Schaeffer, and Prof. Gill.

Mr. John A. Ryder read a paper on The Rationale of the So-called Fattening Process in the Oyster;† and in his remarks explained the cause of the green color in certain oysters especially prized by oyster eaters in Europe.

Thirty-Fifth Meeting, November 24, 1882.

The President occupied the chair. Forty-four members were present.

Professor Lester F. Ward read a letter from Doctor Edward Foreman, suggesting the importance of the appointment of a com-

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* 1883. True, Frederick W. On a Cinnamon Bear from Pennsylvania. <Proceedings U. S. National Museum, V, pp. 653-6, 1883.

† 1881. Ryder, John A. An account of Experiments in Oyster Culture and observations relating thereto, etc. <Report of T. B. Ferguson, a Maryland Commissioner of Fisheries, for 1881, Appendix A, pp. 1-64. Also in A Contribution to the Life History of the Oyster. <The Fishery Industries of the United States, pp. 711-750, 1885.

mittee to take action looking toward the preparation of a list of the trees and shrubs growing in the streets, parks, cemeteries, and other public grounds of the District of Columbia. In accordance with the suggestions in this letter, the following committee was appointed to act in co-operation with the Secretary of the Smithsonian Institution in the preparation of such a list: Prof. Lester F. Ward, Dr. George Vasey, Mr. Wm. R. Smith, Dr. F. B. Hough, and Dr. Edward Foreman.

Dr. Elliott Coues read a paper on THE PRESENT STATUS OF THE AVIFAUNA OF THE DISTRICT OF COLUMBIA,* presenting extracts from the new list of the birds of the District, just compiled by himself and Dr. D. W. Prentiss. The total number of species of birds now known to occur in the District is 248, 23 having been added to the list since 1862.

Prof. C. V. Riley made remarks upon JUMPING SEEDS AND GALLS,† and exhibited specimens of the so-called "Mexican jumping seeds" or "devil-beans," the seeds of a Euphorbia-like plant, in the interior of which are the larvæ of a species of moth, *Carpocapsa saltitans*, which, by their uneasy motions, cause peculiar twitching movements of the seeds. He also showed a peculiar gall from the under side of the leaves of various oaks of the white oak group, which is moved in a similar manner by the larvæ of a species of Cynips, *Cynips saltatorius*, which lives curled up within it.

Dr. Thomas Taylor spoke on the PEAR-TREE BLIGHT, its cause and prevention, illustrating his remarks with specimens.

Prof. Lester F. Ward presented a paper on ADDITIONS MADE TO THE FLORA COLUMBIANA DURING THE SEASON OF 1882,‡ exhibiting specimens of 27 species of plants added to the flora of the District of Columbia.

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* Included in—

1883. COUES, ELLIOTT, and D. WEBSTER PRENTISS. Avifauna Columbiana; being a list of birds ascertained to inhabit the District of Columbia, &c. <Bulletin U. S. National Museum, No. 26. 8°. pp. 133, 4 maps.

† 1883. RILEY, CHARLES V. Jumping Seeds and Galls. <Proceedings U. S. National Museum, V, pp. 632–635, with one cut, 1883.

‡ 1884. WARD, LESTER F. List of plants added to the Flora of Washington from April 1, 1882, to April 1, 1884. <Proc. Biol. Soc. Washington, II, pp. 84–87, 1882–4. Extras, April 10, 1884.

The President announced the proposal to publish a second edition of Vol. I of the *Proceedings of the Biological Society*, should a sufficient number of subscriptions for copies of the same be made.*

THIRTY-SIXTH MEETING, December 8, 1882.

The President occupied the chair. Thirty-seven members were present.

The President announced that the Lecture Committee had arranged for a course of Saturday lectures to young people, as follows:

December 16, 1882: Prof. O. T. MASON. The Circle of the Sciences.

December 23, 1882: Mr. WILLIAM H. DALL. Ocean Currents.

December 30, 1882: Mr. FREDERICK W. TRUE. Swimming Quadrupeds.

January 6, 1883: Prof. J. W. CHICKERING, Jr. The Grasses.

Prof. L. F. Ward stated that the committee appointed at the last meeting to prepare a list of the trees and shrubs growing in the streets, parks, cemeteries, and other public grounds of the District of Columbia had held a meeting and apportioned the work.

Prof. J. W. Chickering, Jr., being called to the chair, Prof. Gill discussed THE CHARACTERS AND RELATIONS OF THE STROMATEIDÆ.†

Dr. D. W. Prentiss followed with remarks on CHANGES PRODUCED IN THE BIRD FAUNA OF THE DISTRICT OF COLUMBIA BY MODIFICATION OF ITS TOPOGRAPHY.‡

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* A supplementary edition of 100 copies was eventually printed at the cost of the Society.

† 1884. GILL, THEODORE. Notes on the Stromateidæ. Proc. Amer. Phil. Soc., 1884, pp. 664–72.

‡ Included in—

COUES and PRENTISS. Avifauna Columbiana, already cited.

THIRTY-SEVENTH MEETING, December 22, 1882.

The President occupied the chair. Thirty-four members were present.

Dr. T. H. Bean read a paper ON THE OCCURRENCE OF THE ALEWIFE IN CERTAIN LAKES OF NEW YORK.* The alewife (*Clupea vernalis*) which is identical with the branch herring of the Potomac, has been observed in immense numbers in Lake Ontario, and Cayuga and Seneca Lakes, New York—its first appearance having been in 1873. It is supposed to have been accidentally introduced by fish-culturists when planting young shad. In the discussion of this paper Messrs. Smiley, Barnard, True, Ryder, and Goode participated. Mr. Ryder spoke of observations on a supposed hybrid between the shad and the rock-fish.

Prof. Riley read a paper on THE LIGNIFIED SERPENT OF BRAZIL,† a curious object lately discussed in scientific journals in France and the United States, and pronounced by M. Olivier, a French *savant*, to be an actual serpent converted into woody tissue. This he demonstrated to be a woody formation developed in the burrow of the larva of a wood-boring insect, which, by some slight artificial changes, had been made to resemble a serpent still more than in its original condition.

THIRTY-EIGHTH MEETING, January 5, 1883.

(Third Annual Meeting.)

The President occupied the chair. Sixty-six members were present.

The following board of officers was elected:

President—Prof. C. A. WHITE.

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* 1884. BEAN, TARLETON H. On the Occurrence of the Branch Alewife in Certain Lakes of New York. <The Fishery Industries of the United States. Part I. pp. 588–593.

† 1883. RILEY, CHARLES V. The Lignified Serpent of Brazil. <Washington *Evening Star*, Jan. 20, 1883; *Scientific American* Supplement, Feb. 17, 1883, and various other journals.

Vice-Presidents—Prof. Theodore Gill, Prof. C. V. Riley, Prof. L. F. Ward, Mr. William H. Dall.

Secretaries—Mr. G. Brown Goode, Mr. Richard Rathbun.

Treasurer—Dr. Tarleton H. Bean.

Council—Prof. O. T. Mason, Dr. George Vasey, Dr. D. Webster Prentiss, Mr. Frederick W. True, Dr. Elliott Coues.

Saturday Lectures, 1883.

The second regular course of Saturday Lectures, under the auspices of the Biological Society and the Anthropological Society, was begun January 13, 1883, and the following programme was carried out:

January 13: Capt. C. E. Dutton, U. S. A. On Rivers.

January 20: Prof. O. T. Mason. The Races of Men.

January 27: Mr. George Kennan. Mountains and Mountaineers of the Caucasus.

February 3: Dr. D. W. Prentiss. Mesmerism in Animals.

February 10: Prof. Theodore Gill. Mythical Animals.

February 17: Dr. John S. Billings, U. S. A. Germs and Epidemics.

February 24: Prof. Lester F. Ward. The Plant Life of the Globe, past and present.

March 3: Mr. William H. Dall. Pearls and Pearl Fisheries.

March 10: Major J. W. Powell. Indian Mythology.

March 17: Prof. C. V. Riley. Adaptation and Interdependence between Plants and Insects.

March 24: Prof. C. A. White. The Teachings of Paleontology.

March 31: Dr. Robert Fletcher, U. S. A. Human Proportion in Art and Anthropometry.

Thirty-Ninth Meeting, January 19, 1883.

Thirty-one members were present.

Professor C. A. White, the newly-elected President, took the chair, and, after a few remarks, introduced the retiring President,

Professor Theodore Gill, who delivered an address upon THE PRINCIPLES OF ZOOGEOGRAPHY.*

The attendance being small, upon motion of Mr. Goode, it was voted that action upon the pending constitutional amendment be deferred until the next meeting.

FORTIETH MEETING, February 2, 1883.

The President occupied the chair. Forty-three members were present.

Article X of the Constitution was amended to read as follows, the changes made being indicated by italics:

ARTICLE X.

FEES.

The initiation fee shall be one dollar; the annual fee, *two* dollars. Members in arrears for one year shall, after due notification by the Treasurer, be dropped from the rolls, *except in the case of those absent from the city for one year or more, who may be retained on the list as non-resident members during their absence.* No member in arrears shall be entitled to vote at the annual meeting for the election of officers.

In the discussion of the address delivered by the retiring President, Professor Gill, at the last meeting, Prof. Ward, Mr. Dall, Prof. White, and Mr. Elliott participated, and Prof. Gill spoke at some length in continuation of it.

Dr. Elliott Coues read a paper upon ZOOLOGICAL NOMENCLATURE APPLIED TO HISTOLOGY.

FORTY-FIRST MEETING, February 16, 1883.

The President occupied the Chair. Forty members were present.

In the discussion of the paper on Zoological Nomenclature Ap-

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*Proc. Biol. Soc. Washington, Vol. II, pp. 1–40, 1882–84. Extras printed, with cover and title page, as follows: The | Principles of Zoogeography, | A Presidential Address | delivered at the | Third Anniversary Meeting of the Biological Society | of Washington, January 19, 1883, | by | Theodore Gill, A. M., M. D., Ph. D., | Member of the National Academy of Sciences, &c., &c. | * * * | Washington, D. C. | Judd & Detweiler, Printers. | 1884. 8vo. 40 pp.

plied to Histology, presented by Dr. Coues at the previous meeting, Mr. N. P. Scudder led with a paper on Biology and Classification.

Mr. John A. Ryder read a paper On the Structures of Protoplasm and Karyokynesis.*

Forty-Second Meeting, March 2, 1883.

The President occupied the chair. Forty-three members present.

Prof O. T. Mason read a paper on The Human Fauna of the District of Columbia, and Dr. M. G. Ellzey spoke on Hybrid Sterility, being a plea against the hypothesis of evolution.

Forty-Third Meeting, March 16, 1883.

The President occupied the chair. Fifty members were present.

Dr. Ellzey's paper, presented at the last meeting, was discussed by Mr. Henry W. Elliott and others.

Mr. Orville A. Derby, Curator of the Geological Department of the National Museum of Brazil, under the title of Biological Notes from Brazil, gave an account of the present condition of biological science in that country. Remarks were made by Messrs. White and Elliott.

Lieut. Francis Winslow, U. S. N., read a short paper on The Giant Clams of the Pacific,† exhibiting specimens.

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* 1882. Ryder, John A. Observations on the absorption of the yelk, the food, feeding, and development of embryo fishes, comprising some investigations conducted at the Central Hatchery, Armory Building, Washington, D. C., in 1882. <Bulletin U. S Fish Commission, II, pp. 179–205, 1882. (XII—Specific character of protoplasm, pp. 202–205.)

† 1883. Winslow, Francis. Catalogue of the Economic Mollusca. <Descriptive Catalogues of the Collections sent from the United States to the International Fisheries Exhibition, London, 1883. Bull. U. S. National Museum, No. 27, Part D, pp. 185–270, 1883.

Mr. John A. Ryder showed some microscopical sections of hermaphroditic oysters.*

A specimen of a fossil log of the Cretaceous age, showing the borings of a ship-worm, was exhibited by the President, and remarks upon similar borings in recent times were made by Mr. A. B. Johnson.

Mr. George P. Merrill exhibited a nodule and microscopic section of carbonate of iron (Siderite) occurring in coal.

Mr. Hornaday read a paper on THE MENTAL CAPACITY OF THE ELEPHANT,† which was discussed by Messrs. Ward, Elliott, and Mason.

FORTY-FOURTH MEETING, March 30, 1883.

The President occupied the chair. Thirty-eight members were present.

Mr. Newton P. Scudder made a communication upon THE LENGTH OF THE HATCHING PERIOD OF THE DOMESTIC FOWL. In the experiments which he made, the period varied from 17 to 21 days. Remarks were made upon the paper by Messrs. Hough, Ellzey, Mason, and Schaeffer.

Dr. Thomas Taylor read a paper upon A NEW PARASITE IN FOWLS OF THE NATURE OF TRICHINA,‡ and also made some remarks upon SECTION CUTTING AND THE MOUNTING OF HARD WOODS, which were supplemented by Dr. F. B. Hough, who exhibited sections of woods prepared in Japan and Germany.

Mr. F. A. Lucas exhibited drawings showing the results of accidents upon the bones of wild animals. Mr. Frederick W. True exhibited bones of the extinct arctic sea-cow, *Rhytina*, collected by Dr.

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* 1882. RYDER, JOHN A. The Microscopic Sexual Characteristics of the American, Portuguese, and Common Edible Oyster of Europe Compared. <Bulletin of the U. S. Fish Commission, II, pp. 205–15, 1882; and Annals and Magazine of Natural History, London, Oct., 1883.

† 1883. HORNADAY, WILLIAM T. The Mental Capacity of the Elephant. <Popular Science Monthly, August, 1883, pp. 497–509.

‡ 1883. TAYLOR, THOMAS. Internal Parasites in Domestic Fowls. <Department of Agriculture, Washington, 1884, 5 pp.; Proc. Am. Micro. Soc., 1883.

Leonard Stejneger, a member of the Society, and recently received from Bering Island. Prof. Chickering read a paper upon THE PHYSICAL FEATURES OF MOUNT KATAHDIN.

FORTY-FIFTH MEETING, April 13, 1883.

The President occupied the chair. Thirty-six members were present.

The Committee on Field Meeting reported favorably upon holding such a meeting at Bladensburg, April 28th, and upon inviting ladies to attend. The report was accepted by the Society.

Prof. Lester F. Ward presented a communication upon THE HYBRID OAKS OF THE DISTRICT OF COLUMBIA. Numerous pressed leaves were exhibited.

Mr. B. F. Johnson presented a nôte upon THE MODE IN WHICH THE GARTER SNAKE CLIMBS UPON A SMOOTH VERTICAL SURFACE, representing it as somewhat similar to that in which a man climbs. The movement is not a spiral one. The note was commented upon by Messrs. Baker, Schaeffer, Gill, Mason, and Taylor.

Prof. C. V. Riley made a communication upon THE BAG WORM, THYRIDOPTERYX EPHEMERÆFORMIS,* which is abundant in the District of Columbia and elsewhere.

Mr. F. W. True made a few remarks upon A PARASITIC WORM FOUND IN THE EGG OF A COMMON HEN.

Dr. Thomas Taylor presented a communication upon PARASITIC MITES IN THE LUNG-CAVITIES AND TISSUES OF DOMESTIC FOWLS.†

In the discussion which followed, Messrs. Ward and Riley participated. Specimens were exhibited with the two latter communications.

FORTY-SIXTH MEETING, April 27, 1883.

The President occupied the chair. Thirty members were present.

Prof. C. V. Riley exhibited specimens of A MEXICAN JUMP-

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* Proc. Biol. Soc. Washington, vol. II, 1882–84, pp. 80–83. Extras, April 10, 1884.

† See citation at foot of page XL.

ING SEED, and also made REMARKS UPON BEE-FLY LARVÆ AND THEIR SINGULAR HABITS, and upon a BURROWING BUTTERFLY LARVA.

Mr. H. H. Birney read a paper upon THE AILANTHUS MOTH, SAMIA CYNTHIA, which was discussed by Messrs. Riley and Mann.

Dr. Frank Baker read a paper upon THE ORIGIN OF DEXTRAL PREFERENCE IN MAN. It was discussed by Messrs. King, Ellzey, Ward, Mason, Toner, Mann, Gill, and Riley.

FIELD MEETING AT BLADENSBURG, April 28, 1883.

A field meeting was held at Bladensburg, Maryland, and was attended by a number of members of the Society.

FORTY-SEVENTH MEETING, May 11, 1883.

The President occupied the chair. Twenty-two members were present.

Prof. Ward made a communication entitled NOTES ON SOME HITHERTO UNDESCRIBED FOSSIL PLANTS FROM THE LOWER YELLOWSTONE AND COLLECTED BY Dr. C. A. WHITE IN 1882.*

Mr. True made remarks upon A NEW PIGMY SPERM WHALE FROM THE NEW JERSEY COAST,† which he proposed to name *Kogia Goodei*.

Dr. Thomas Taylor offered a communication ON ACTINOMYKOSIS, a new infectious disease in man and the lower animals, and exhibited specimens of the fungus *Actinomyces*, from the viscera of a diseased dog. The discussion was adjourned to the next meeting.

FORTY-EIGHTH MEETING, May 25, 1883.

Prof. Theodore Gill, Vice-President, occupied the chair. Twenty members were present.

Dr. Thomas Taylor continued his remarks upon a recently dis-

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* This paper will be incorporated with a forthcoming report to the Director of the U. S. Geological Survey.

† 1883. TRUE, FREDERICK W. A New Sperm Whale (*Kogia Goodei*). <Science, I, p. 470, 1883.

covered and very dangerous disease, known as *Actinomykosis*, which affects domestic animals.

Dr. D. E. Salmon read a paper on the same disease. The communications called forth an animated discussion, in which Drs. Taylor, Salmon, Schaeffer, and others participated.

The Society then adjourned, subject to call by the President in October.

FORTY-NINTH MEETING, October 19, 1883.

The President occupied the chair. Thirty-five members were present.

Prof. Theodore Gill presented a communication on THE ICHTHYOLOGICAL RESULTS OF THE EXPLORATIONS OF THE U. S. FISH COMMISSION STEAMER "ALBATROSS" IN 1883.* He called attention to a number of new fishes, including two representatives of new orders, for which he proposed the names Lyomeri and Gnathenchelyi.

Dr. C. A. White made some remarks upon THE CHARACTER AND FUNCTION OF THE EPIGLOTTIS OF THE BULL SNAKE (PITYOPHIS).†

Prof. Lester F. Ward exhibited an interesting botanical relic of the District of Columbia, consisting of the original minutes of the Proceedings of the Washington Botanical Society, which became extinct in 1835.

Prof. C. V. Riley read a paper on MANNA IN THE UNITED STATES, and exhibited and remarked upon some specimens of a kind of Manna recently received from Chewelah, Washington Territory. This communication was discussed by Messrs. Taylor, Schaeffer, Vasey, Toner, and Ward.

FIFTIETH MEETING, November 2, 1883.

The President occupied the chair. Forty members were present.

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* The substance of this communication was published in three papers in Forest & Stream, 1883, and in other papers in the American Naturalist and the Proceedings of the U. S. National Museum.

† 1884. WHITE, CHARLES A. On the Character and Function of the Epiglottis in the Bull Snake (Pityophis). American Naturalist, XVIII, pp. 19–21, 1884.

Dr. G. M. Sternberg, U. S. A., of San Francisco, read a paper ON MICROCOCCI.*

Dr. E. M. Schaeffer made some remarks upon Manna, in continuance of those made by Prof. Riley at the previous meeting. He also exhibited specimens of a possibly new variety or species of *Ceratophyllum*. Dr. T. H. Bean exhibited a curious specimen of a species of flounder, *Paralichthys dentatus*, and spoke of ARRESTED ASYMMETRY IN FLOUNDERS.

Prof. L. F. Ward related the result of his investigations of a supposed deposit of fossil timber on the site of the new "Casino," in process of erection on Connecticut avenue.

FIFTY-FIRST MEETING, November 16, 1883.

The President occupied the chair. Forty-five members were present.

Prof. L. F. Ward read a paper on MESOZOIC DICOTYLEDONS. †

Mr. C. D. Walcott presented a communication on FRESH-WATER SHELLS FROM THE LOWER CARBONIFEROUS, illustrating his remarks with specimens.‡

Mr. Frederick W. True exhibited a specimen of THE WEST INDIAN SEAL, MONACHUS TROPICALIS, recently received by the National Museum, and discussed the history of the specimen and the affinities of the species.

Dr. C. A. White narrated an incident of his experience as an explorer in the Upper Missouri Valley, illustrative of THE PERSISTENCE OF THE DOMESTIC INSTINCT IN THE CAT.§ An animated

* STERNBERG, GEORGE M. Bacteria. | By | Dr. Antoine Magnin, | Licentiate of Natural Science, * * * | and | George M. Sternberg, M. D., F. R. M. S., | Major and Surgeon, U. S. Army; Member of the Biological Society of Wash- | ington; late member of the Havana Yellow Fever Commission of the | National Board of Health; | Corresponding Member of the | Epidermological Society of London, etc. | New York: | William Wood & Company, | 56 and 58 Lafayette Place. | 1884. 8vo. pp. XVIII, 9-494.

† 1884. WARD, LESTER F. Mesozoic Dicotyledons. <Am. Jour. Sci. and Arts, 3d Ser., XXVII, pp. 292-303, 1884; Annals and Mag. Nat. Hist., London, 5th Ser., XIII, pp. 383-396, 1884.

‡ 1883. WALCOTT, CHARLES D. Fresh-water Shells from the Paleozoic Rocks of Nevada. <Science, II, p. 809, 1883.

§ 1884. WHITE, CHARLES A. The Permanence of the Domestic Instinct in the Cat. <American Naturalist, XVIII, pp. 213-14, 1884.

discussion of this incident, and of other topics suggested by it, was participated in by Prof. Riley, Mr. N. P. Scudder, Mr. A. B. Johnson, Mr. Benjamin Miller, Prof. Ward, Dr. Toner, and others.

Fifty-Second Meeting, November 30, 1883

The President occupied the chair. Fifty members were present.

A letter was read from the Secretary of the Philosophical Society of Washington, inviting the Biological Society to attend the meeting of the Philosophical Society, to be held at the National Museum lecture-hall on the 5th proximo, when the President's annual address would be the order for the evening.

Dr. Thomas Taylor described Oidium Tuckeri, the Fungus of the Foreign Grape Vine,* which has of late years been so destructive to European vineyards, giving an account of his discovery of the highest stages of its fruit on the foreign vines now under cultivation in the U. S. Agricultural grounds.

Dr. Frank Baker read an interesting paper entitled The Logical Method of Teaching Anatomy,† which elicited much discussion, participated in by Messrs. Seaman, Prentiss, Johnson, Gill, Norris, Schaeffer, Scudder, Cope, and Ward.

Prof. Theo. Gill exhibited drawings of a very curious deep-sea fish discovered during the past summer in the North Atlantic, at a depth of about two miles, by the U. S. Fish Commission steamer Albatross. It belonged to a new family, which the speaker has denominated the Stephanoberycidæ.‡

The Committee on Lectures announced a provisional programme for the course of Saturday Lectures for 1884, under the auspices of the Anthropological and Biological Societies.

Four courses of these lectures were given, consisting of seventeen lectures, a list of which, as finally arranged, is subjoined.

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* 1884. Taylor, Thomas. On the Fungus of the Foreign Grape Vine. <American Microscopical Journal, V, p. 5, 1884.

† 1884. Baker, Frank. The Rational Method of Teaching Anatomy. <Medical Record, N. Y., April 19, 1884; also as extra, 16°, pp. 20, with special title.

‡ 1884. Gill, Theodore. Three new families of fishes added to the deep-sea fauna in a year. <American Naturalist, XVII, p. 433, 1884.

January 5: Mr. GROVE K. GILBERT. Cliffs and Terraces.

January 12: Prof. OTIS T. MASON. Child Life among Savage and Uncivilized Peoples.

January 19: Prof. EDWARD S. MORSE. Social Life among the Japanese.

January 26: Major J. W. POWELL. Win-tun Mythology.

February 2: Prof. F. W. CLARKE. Lightning and Lightning-Rods.

February 9: Capt. C. E. DUTTON, U. S. A. The Hawaiian Islands and People.

February 16: Prof. E. D. COPE. The Origin of Human Physiognomy.

February 23: Mr. JOHN MURDOCH. Eskimo Life at Point Barrow.

March 1: Prof. HARVEY W. WILEY. The Sugar Industry of the North.

March 8: Prof. SIMON NEWCOMB. Psychic Force.

March 15: Mr. JOHN A. RYDER. Protoplasm in the Light of Recent Investigations.

March 22: Dr. FRANK BAKER. The New Phrenology.

March 29: Capt. C. E. DUTTON, U. S. A. Volcanoes.

April 5: Prof. T. C. CHAMBERLIN. The Great Ice Invasion of North America.

April 12: Dr. W. W. GODDING. What shall we do with the Inebriates?

April 19: Prof. J. S. NEWBERRY. The Industrial Arts as Factors in Modern History.

April 26: Major J. W. POWELL. The Cañons of the Colorado.

FIFTY-THIRD MEETING, December 14, 1883.

The President occupied the chair. Forty-five members were present.

Prof. C. V. Riley presented a paper, read by Dr. Barnard, on the use of NAPHTHALINE AS AN INSECTICIDE,* in discussing which Dr. Thomas Taylor and Prof. W. S. Barnard participated.

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* 1884. RILEY, C. V. The use of Naphthaline as an Insecticide. <Science, III, pp. 455–456, 1884.

Mr. Henry W. Elliott read a paper CONCERNING THE APPETITE OF THE MUSKRAT,* which was discussed by Dr. Ellzey, Dr. Schaeffer, and others.

Dr. R. W. Shufeldt, U. S. A., read a paper on THE PRESENT CONDITION OF THE ANATOMICAL COLLECTIONS OF THE ARMY MEDICAL MUSEUM.

FIFTY-FOURTH MEETING, December 28, 1883.

The President occupied the chair. Forty-four members were present.

Dr. Thomas Taylor read a paper on NAPHTHALINE AND ITS EFFECTS ON PLANTS, INSECTS, AND OTHER ANIMALS,† exhibiting specimens of plants which had been treated with naphthaline without suffering injury.

Dr. W. S. Barnard read a paper on SOME RESULTS BY MASSAGE ET CONTRE-COUP.‡

Mr. John A. Ryder made a communication on THE STRUCTURE OF THE EGG MEMBRANE IN FISHES.

Mr. Romyn Hitchcock exhibited an improved form of microscope stand.

FOURTH ANNUAL MEETING, January 11, 1884.

The fourth annual meeting of the Biological Society took place on Friday evening, January 11. Thirty-five members were present, President White occupying the chair. Prof. Ward gave notice of a proposition to change the days of meeting to the Saturdays alternating with those of the Philosophical Society.

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* 1884. ELLIOTT, HENRY W. The Destruction of Carp by the Muskrat (Fiber zibethicus). Methods of Trapping the Rodent. <Bull. U. S. Fish Commission, IV, pp. 296–7, 1884.

† 1884. TAYLOR, THOMAS. Naphthaline as an Insecticide, etc. 8vo, 6 pp., 1884.

‡ Proc. Biol. Soc., Washington, II, p. 116, 1882–84.

The Society then proceeded to ballot for the election of officers for the ensuing year, with the following result:

President—Dr. C. A. White.

Vice-Presidents—Mr. W. H. Dall, Prof. L. F. Ward, Prof. Theodore Gill, Prof. C. V. Riley.

Secretaries—Mr. G. Brown Goode, Mr. Richard Rathbun.

Treasurer—Dr. Tarleton H. Bean.

Members of Council—Prof. O. T. Mason, Dr. George Vasey, Mr. F. W. True, Dr. D. Webster Prentiss, Mr. John A. Ryder.

Fifty-Sixth Meeting, January 25, 1884.

The Fourth Anniversary Meeting of the Society was held January 25, on which occasion a large number of guests of the Society, members of the Philosophical and Anthropological Societies, and others, were present, by invitation, in the lecture-room of the National Museum. Dr. White read the presidential address, the topic discussed being Certain Phases in the Geological History of North America, Biologically Considered,* and was listened to with great pleasure and interest. The Presidents and Vice-Presidents of the Philosophical and Anthropological Societies occupied seats on the stage. The speaker was introduced by Dr. J. C. Welling, President of the Philosophical Society. At the close of the address a vote of thanks was moved by Major J. W. Powell, President of the Anthropological Society.

Fifty-Seventh Meeting, February 8, 1884.

The President occupied the chair. Thirty-six members were present.

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* Proc. Biol. Soc. Washington, II, pp. 41–66, 1882-84. Extras printed, with cover and title page, as follows:

Certain Phases | in the | Geological History of the North American | Continent, Biologically Considered. | By | Charles A. White, A. M., M. D., | Paleontologist to the U. S. Geological Survey, Honorary Curator of the Depart | ment of Fossil Invertebrates in the U. S. National Museum. | Presidential address, | delivered at the | Fourth Anniversary Meeting of the Biological Society | of Washington, January 25, 1884. | * * * | Washington: | Judd & Detweiler, printers. | 1884. 8vo. 26 pp.

Mr. William T. Hornaday read a paper on THE GUACHARO BIRD OF TRINIDAD, *Steatornis caripensis*, in which he said that this strange bird was sometimes found breeding in almost inaccessible caverns opening on the sea, at the northwestern point of the island of Trinidad, in one of which, a large dome-like cave, he had found about two hundred birds. The guacharo was, perhaps, the only frugiverous bird of purely nocturnal habits, and was closely allied to the goat-suckers. The young birds have a thick layer of fat on the abdominal region, which yields a clear, transparent oil of great purity, highly esteemed by the natives for cooking purposes. The nest of the guacharo, the speaker said, resembled a small brown cheese, slightly hollowed on the top, being composed of the undigested remains of fruit firmly adhering together.

Mr. G. Brown Goode read a paper on THE AIMS AND LIMITATIONS OF MODERN FISH-CULTURE.* Modern fish-culture he defined to be fish-culture carried on under government patronage upon an extensive scale, under the direction of men trained to scientific research, as distinguished from the old and insignificant method of fish-culture carried on by private enterprise. Its aims were shown to be, (1) to arrive at a complete understanding of the life histories of useful aquatic animals and the conditions under which they live; and (2) to apply this knowledge so thoroughly that all fishes shall be brought as completely under control as are now the shad, the salmon, the carp, and the whitefish. The limitations of fish-culture were shown to be the same as those of scientific stock-rearing or agriculture.

In the discussion which followed, Prof. L. F. Ward remarked that he had been interested in the paper especially on account of the broad general principles in political economy which had been shown to underlie the subject discussed; that the lessons which the United States, by means of its participation in the London Fisheries Exhibition and its successes in the field of fish-culture, had taught to Europe, and especially to Great Britain, were of great importance. Political economists of the Manchester school need to be shown in just such a way as this that the policy of State con-

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*GOODE, G. BROWN. Article "Pisciculture." <Encyclopædia Britannica, Vol. XIX, 1885.

trol and management for large enterprises, involving large outlays of money, is the only policy which can be successfully carried out.

Mr. C. W. Smiley stated that, in spite of shad-hatching having been prosecuted with increasing vigor annually since 1874, the number brought into the Washington market had decreased from 521,368 in 1881, to 350,292 in 1882, and 261,474 in 1883. But for fish-culture the decrease would have been enormously greater. He affirmed that we are yet ignorant of many essential elements of fish propagation, and only the highest scientific ability can discover them.

Dr. T. H. Bean, referring to Mr. Smiley's statement, said that it was manifestly unfair that fish-culture should be expected to do more than nature could do in keeping up the supply of fish in any body of water; that there were many things for the fish-culturist to do besides the planting of young fish; that the pollution of streams and the artificial obstructions, such as dams, must first be removed, and that in interpreting the results of fish-culture, questions of temperature, freshets, and other natural disturbances of ordinary conditions upon the breeding grounds of fishes, should be taken into account.

Dr. T. H. Bean exhibited a specimen of pipe-fish, *Siphostoma*, *sp.*, which showed an augmented development of fins, the supernumerary fin being post-anal, and much more developed than the ordinary rudimentary anal of the male *Siphostoma*. In size and general appearance it resembled more nearly a caudal fin, but from its position it must be called post-anal. In the Lophobranchiates he believed that the vertical fins are not developed from an embryonic fin-fold, as is the case in most fishes. This example was to be considered as an illustration of a reversion to a former condition of fishes of this type, in which they did possess at one stage of their existence an embryonic fin-fold.

Mr. Ryder remarked that the specimen of *Siphostoma* with supernumerary anal fin was certainly an example of the restoration towards the ancestral form. Its presence might be explained on the supposition that the fin-fold, which is continuous in the embryo, had been exaggerated into development at this particular point, and mesoblastic tissue thrust out in the process of development into the fold itself, thus furnishing the rudiments upon which there was

an attempt to again return to the ancient isocercal form of the vertical fins.

Mr. C. D. Walcott exhibited a specimen of trilobite, *Asaphus platycephalus*, in which twenty-six pairs of legs were plainly seen, no mouth parts being visible. These were shown by a drawing illustrating Mr. Walcott's restoration of the mouth appendages of the trilobite, as published by him in the Bulletin of the Museum of Comparative Zoology, Vol. VIII, No. 10, 1881. The specimen was the same as that described by Prof. Mickleborough, of Cincinnati.* Mr. Walcott also showed a specimen of metamorphic rock having a granitic structure and containing fossil corals, probably of the Devonian age.

Prof. L. F. Ward moved that the meeting day of the Society be changed to Saturday. After remarks by Dr. Baker, Dr. Coues, and others, the motion was carried by a unanimous vote.

Fifty-Eighth Meeting, February 23, 1884.

The President occupied the chair. Thirty-six members were present.

Dr. Elliott Coues read a paper on The Present State of North American Ornithology. In discussing the precontemporaneous history of the subject, he spoke of the following epochs:—

(1) The Archaic (prior to 1700); (2) the Pre-Linnæan (1700–1758); (3) the Post-Linnæan (1758–1800); (4) the Wilsonian (1800–1824); (5) the Audubonian (1824–1853); (6) the Bairdian (1853–18—). A number of periods were also defined as follows: (1) the Lawsonian period (1700–1730), named after Lawson, the author of the first American faunal list, that for North Carolina; (2) the Catesbian period (1730–1748), named after Mark Catesby, the first to publish an illustrated work on American birds; (3) the Edwardsian period (1748–1758), named after George Edwards, whose great work on birds was founded largely upon American material; (4) the Linnæan period (1758–1766), the period during which the binomial nomenclature was being developed; (5) the

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* 1884. Walcott, Charles D. Appendages of the Trilobite. <Science, III (No. 57), pp. 279-81, 1884.

Forsterian period (1766–1785), named for George Reinbold Forster, who was the first to publish a catalogue of the birds of North America, and who also first published a special paper on a collection of American birds sent to Europe; (6) the Pennantian period (1785–1791), marked by the labors of Pennant and Latham; (7) the Bartramian period (1791–1799), named for John Bartram, the first resident of America to publish a work on its birds; (8) the Vieillotian period (1800–1808); (9) the Wilsonian period (1808–1824), named after the first great American ornithologist; (10) the Bonapartian period (1824–31), during which the impress of science was laid upon the woodland genius of Wilson; (11) the Richardsonio-Swansonian period (1831–2); (12) the Nuttallian period (1832–4), marked by the appearance of the first of American ornithologists; (13) the Audubonian period (1834–1853), named after the most brilliant of ornithologists, marked by the publication of what Cuvier called the "grandest monument ever erected by art to nature;" (14) the Cassinian period (1853–58), named for John Cassin, the best general ornithologist America has known; (15) the Bairdian period.

The establishment of the American Ornithologists' Union, he thought, would probably mark the beginning of a new epoch—one in which the existing intricacies of ornithological nomenclature will, it is hoped, be straightened out. The present is simply a period of transition.

Dr. Coues laid before the Society the plate proofs of the forthcoming new edition of his Key to North American Birds.

Mr. Walcott having received, since the last meeting of the Society, on February 8, a number of additional specimens of the granitic-like rock containing fossil Stromatopora, corals, plates of crinoid stems, etc., from Litchfield, Maine, exhibited them and said that he was incorrect in calling the rock a granite as it was of sedimentary origin, a plastic rock so changed in the specimens examined that it might be called a conglomerate gneiss.

Mr. J. S. Diller stated that he had examined thin sections of the rock under the microscope, which showed it to be chiefly crystalline, and composed almost entirely of quartz and feldspar. These minerals occur as irregular angular grains, which, for the most part, have crystallized in their present position in such a manner as to fill up the whole space. There is but little trace, as far as can be

seen under the microscope, of the sedimentary character of the rock. The irregular angular quartz grains are clouded with liquid inclusions containing dancing bubbles. The feldspar is in large part plagioclase, for, notwithstanding the alteration, the characteristic striæ in polarized light are yet distinct. Distinct silvery scales of muscovite occur sparingly, so that the rock has the composition of a gneiss, which, on account of the distinct quartz fragments it contains, may be called conglomerate gneiss.

Mr. G. P. Merrill thought it was premature to decide upon the character of the rock, but that, as far as he had examined it, he agreed with Mr. Diller as to its characters.

Prof. Lester F. Ward exhibited specimens of the "diamond willow," a form of *Salix cordata* occurring in the Upper Missouri region, distinguished by a great exaggeration of the scars left by the early growth of limbs, which form series of large diamond-shaped cavities in the wood. He also exhibited some remarkable canes carved by the people of that region from saplings of this species.

Prof. Seaman advanced the theory that the scars were produced by a fungus or an insect.

The following papers were read by title:

Mr. Robert Ridgway. Descriptions of some new North American Birds. Description of a new American Kingfisher. Note on *Psaltriparus grindæ* Belding. Note on the generic name *Calodromas*.*

Mr. Leonhard Stejneger. Diagnoses of new species of Birds from Kamtschatka and the Commander Islands.†

Dr. T. H. Bean and Mr. H. C. Dresel. Diagnoses of three new species of Fishes from the Gulf of Mexico.‡

Fifty-Ninth Meeting, March 8, 1884.

The President occupied the chair, and forty-five members were present.

Dr. J. H. Kidder, U. S. N., exhibited specimens of *Bacillus*

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* Proc. Biol. Soc. Washington, II, pp. 89–97. Extras printed April 10, 1884.

† Ibid., pp. 97–99. Extras printed April 10, 1884.

‡ Ibid., pp. 99–100. Extras printed April 10, 1884.

tuberculosis Koch, the *bacillus* of Phthisis, and summarized the present state of knowledge as to the nature of tuberculosis. Dr. S. M. Burnett stated that tuberculosis frequently occurs spontaneously in the eye. Dr. D. E. Salmon defended the reputation of Toussaint as the discoverer of *micrococcus* in tuberculosis, and remarked that Koch's *bacillus* is not generally admitted to be related to the cause of tuberculosis; that it may or may not be.

Dr. Salmon exhibited specimens of infectious tuberculosis in cattle—the omentum as well as the liver, which was much enlarged, and various glands being thickly covered with large tubercles. These animals were short-horn cattle, of well-known pedigree, in which for thirty years no disease had existed. The disease was, therefore, not hereditary. As soon as one steer had become infected the others in the herd were taken down with the same disease. No traces of *Bacillus tuberculosis* had been discovered.

Mr. C. W. Smiley read a paper on What Fish-Culture has first to Accomplish,* in which he stated that fish-culture cannot be expected to perform the impossible task of filling the waters of a continent to overflowing with an inexhaustible supply of fish, but that it will have to put forth the utmost effort to prevent the entire annihilation of the fish supply by the uncontrollable activity of the fishermen.

Dr. Bean, Mr. Earll, and Mr. Goode participated in the discussion of this paper.

Dr. Tarleton H. Bean remarked that, in his opinion, there was no general impression that fish-culture was going to immediately fill the rivers with fish; that fish-culture never had made such a claim. It did, however, profess to be able to produce fish economically and in greater abundance than could be produced by the natural process; that, furthermore, fish-culture was simply one of a series of means to an end—the object aimed at being the restoration of the fisheries; that fish-culture was one of the means for the accomplishment of that end. In his opinion it was quite as necessary to protect fish as to produce them, for if streams are filled with obstructions and impurities, no amount of fish-culture could restore the fishery in them. The obstructions must be overcome and the

* 1884. Smiley, Charles W. What Fish Culture has first to Accomplish. Bulletin U. S. Fish Commission, IV, pp. 65–68, 1884.

impurities removed, and then the success of fish-culture would be beyond a doubt, as had already been proved by the results accomplished with the California salmon, and the shad on the Pacific coast.

Mr. Earll thought that many enthusiastic fish-culturists had claimed more for the science than could be hoped in the limited time during which it had been carried on, but, on the other hand, he thought that the author of the paper under consideration had gone to the other extreme. Such broad and far-reaching conclusions as had been stated in the paper should be based upon the fullest and most reliable information, extending over a number of years. The statistics on which these conclusions were based were, in his opinion, not of this character. The receipts of fish at the Washington market were not reliable as indicating the catch in the Potomac river, and much less so for the entire Chesapeake basin, which certainly must be taken as a whole when the question of the increase or decrease of the shad is to be considered. The fisheries of this river system had undergone radical changes within the last few years. At one time the fisheries were confined chiefly to the Potomac and Susquehanna, and Washington received a large part of the catch, while now, owing to an enormous development of the fishery interests in the lower Chesapeake, which must necessarily interfere with the catch in those rivers, Norfolk had become an important fishery center, and was receiving immense numbers of shad and other species annually for distribution through the South and West. The introduction of new methods of refrigeration had also enabled the fishermen to send their catch direct to the larger markets without the aid of the Washington dealers.

He did not know the source of Mr. Smiley's statistics of the Sacramento river catch, and was not disposed to question their accuracy, but a recent interview with Mr. A. Booth, the greatest salmon canner of the Pacific coast, had given him quite a different impression. Mr. Booth had assured him that the catch in the Sacramento had been almost miraculously increased, owing to the work of the U. S. Fish Commission, within the last few years. When the Fish Commission began work on that river the catch was almost wholly utilized fresh in the San Francisco and Sacramento markets, and a cannery, built by Mr. Booth at that time, had to be closed after one year for want of a supply. In 1882, fifteen large canneries

were successfully operated on the same river, and about 30,000 pounds beyond what they were able to utilize were thrown away in a single day.

Mr. Earll thought that the time was hardly ripe, and, if it were, the statistics were not available for making such broad generalizations regarding the success or failure of fish-culture. It was gratifying to know that practical business men like Mr. Booth, who had every opportunity of observation, and had large interests at stake, should already be more than satisfied with the results that had come under their observation, and he thought that it might be confidently expected that within the next few years the catch would be very noticeably increased, though, of course, a limit would ultimately be reached, depending upon the enemies of the species and the food which it could find in its natural surroundings.

Col. Marshall McDonald read a paper on THE INFLUENCE OF TEMPERATURE UPON THE MOVEMENTS OF FISH IN RIVERS,* in which the fluctuations of the catch of shad in the Potomac and Susquehanna rivers for 1881, '82, and '83 were explained by reference to the varying temperature of the waters of ocean, bay, and river at the time of their anadromous movements. This paper was illustrated by diagrams. Owing to the lateness of the hour, the Society then adjourned, without discussion.

The following paper was read by title:

Mr. G. BROWN GOODE and Dr. T. H. BEAN. A new genus and species of Pediculate Fishes (*Halieutella lappa*)†.

SIXTIETH MEETING, March 22, 1884.

Prof. C. V. Riley, Vice-President, occupied the chair. Fifty members were present.

Col. Marshall McDonald exhibited a chart showing the natural and restricted river distribution of the shad.

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*1884. MCDONALD, MARSHALL. Natural Causes Influencing the Movements of Fish in Rivers. <Trans. Amer. Fish-Cultural Association, 13th Meeting, 1884, pp. 164–170.

† Proc. Biol. Soc., Washington, II, p. 88, 1882–84.

Dr. R. W. Shufeldt, U. S. A., in a paper entitled Remarks on the Patella,* described the position of this bone, which he considered to be a true sesamoid, in various forms of mammals and birds.

Mr. Romyn Hitchcock exhibited a series of specimens of Orbitolites, and made some remarks upon the results of the work of Dr. William B. Carpenter, as finally set forth in Vol. VII of the report of H. M. S. "Challenger."†

Prof. C. V. Riley presented some Personal Reminiscences of the late Dr. George Engelmann, which were supplemented by remarks from Dr. George Vasey and Prof. Lester F. Ward.

Mr. W. H. Dall read a paper On some Hydrocorallinæ from Alaska and California, exhibiting four new species.‡

Mr. Richard Rathbun exhibited a large mass of coral, *Oculina, sp.*, recently obtained from Key West, growing on the end of a crowbar, which, when further studied, would probably yield some clew as to the rate of growth of the species.

Dr. M. G. Ellzey spoke on The Prepotency of the Male Parent, giving the results of twenty-five years' experience in breeding horses, dogs, and other kinds of live stock. The male parent he believes to be prepotent in the transmission of hereditary traits, except where some extraordinary circumstance intervened. In the case of hybrids between the horse and the ass, a cross is always marked by prepotency of the ass; and in all crosses of the two species the male is always prepotent. Mr. Dall called attention to the danger of drawing conclusions from observations upon the external characters of the products of the union of two species.

Dr. Leonhard Stejneger exhibited two finely mounted specimens of the great Kamtschatkan sea eagle, *Thalassoaëtus pelagicus;* also a specimen of the bald eagle, *Haliæetus leucocephalus*, and a specimen in immature plumage of another species, *hypoleucus*, supposed to be new, and probably, in the adult state, entirely white under-

* 1884. Shufeldt, Robert W. Concerning some of the Forms Assumed by the Patella in Birds. <Proceedings U. S. National Museum, VII, pp. 324–31, 1884.

† 1884. Hitchcock, Romyn. The Causes of Variation. <Amer. Jour. Sci. and Art, XXVIII, p. 49, 1884.

‡ Proc. Biol. Soc. Washington, II, pp. 111–115, 1882–84. Extras printed April 28, 1884.

neath. The rivers of Kamtschatka abound greatly in salmon, and eagles are in consequence particularly numerous.*

Sixty-First Meeting, April 5, 1884.

The President occupied the chair. Forty members were present.

The Secretary gave notice of the following amendment to be proposed to the Constitution: *that ex-presidents of the Society shall be ex-officio members of the Council.*

Dr. Leonhard Stejneger read a paper On the Shedding of the Claws in Ptarmigan,† exhibiting specimens of *Lagopus albus* and *L. ridgwayi* as illustrating his remarks. Some of the specimens had short claws, others long ones, while in others the claws were loose and ready to slip off. The long claws are assumed in summer, and in the winter are supposed to be useful in aiding the birds to walk on the snow—in fact, being similar in action to snow-shoes. He stated that Dr. Coues had observed the same phenomenon in the Lemming, *Myodes*.

Prof. C. V. Riley remarked that this curious adaptation of structure could doubtless be explained by the Lamarckian idea—that it had probably resulted from a direct need of this animal.

Mr. William H. Dall read a paper on The Fishery Exports of San Francisco in 1883.‡ He showed that these consisted of dried shrimps to the value of $82,891, prepared by the Chinese for exportation to China and other countries where Chinese congregate, such as Australia and Peru. The shells are used in China as a fertilizer to the value of $26,288. Abalone products were exported to the value of about $26,000, of which about $8,000 is for the dried

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* 1884. Stejneger, Leonhard. Fra det yderste Œsten, II, Andre fjorten Dage i. Kamtschatka. <Naturen, Christiania, VIII, Jan., 1884, pp. 5–10, figure of eagle, p. 7.

† 1884. Stejneger, Leonhard. On the Shedding of the Claws in the Ptarmigan and Allied Birds. <American Naturalist, XVIII, Aug., 1884, pp. 774–776. Ibis, London, 5 ser., III, Jan., 1885, pp. 50–52.

‡ 1884. Dall, William H. Notes on Fishing Products exported from San Francisco, Cal., during the year 1883. <Bull. U. S. Fish Commission, IV, pp. 125–8, 1884.

flesh sent to China as food, the shells being sent to England and elsewhere for pearl. Of unspecified shells about $400,000 worth are exported, the total value of invertebrate products being over $570,000. Among other articles specified were canned goods. The value of canned salmon exported was over $2,300,000. The total value of fish products was about $4,000,000.

Prof. C. V. Riley made a communication On the Rust of Oranges.

The nature of this rust had been carefully studied by the author and also by one of his assistants, Mr. H. G. Hubbard, at Crescent City, Fla. It has always been known and has always given concern. It varies from a more or less pronounced stain beneath the cuticle to a rough, deep brown incrustation. When heavily coated, the surface is chapped like that of a russet apple. It may be first noticed when the fruit is small, or one-third grown (early summer). It rapidly increases in August and September, when the fruit is full grown, and is most noticed when the fruit begins to color, though there is no increase, but rather a decrease, after that time.

Rusts are mostly due to fungi, but there is nothing of this kind about the orange rust. The oil cells are depleted and the epithelial cells clogged with brownish resin. The surface is fissured and the rind shrinks, toughens, and loses essential oil. Carefully examined, a rusty orange will be found covered with cast mite skins—thick in summer or fall, less noticeable in winter. The mites themselves will be found on the non-rusted fruit and all over the tree in spring and summer. They are so minute as to be scarcely noticeable singly, but collectively give the green leaf and fruit the appearance of being sprinkled with fine golden dust. Pine pollen is often mistaken for them, and they, in turn, for the pollen.

The attacks of the mite are always followed by rust on the fruit, but on the leaves the mites produce only a dull, tarnished appearance, contrasting with the polish of the healthy leaf, and a sure indication of depredation even after the mites have left. The leaves look dry and dusty, with slight loss of color, as from drouth. When the foliage of the tree is bright the oranges are bright. The living mites are not found on rusty oranges; they quit both fruit and leaf, and wander to fresh fields when the oil is depleted or the surface too hardened for their beaks.

The mite (*Phytoptus oleivorus*) is elongate, honey-yellow, 0.14 mm. long, and with two pairs of four-jointed legs, each terminating in a curved spine, with opposing bristles. The eggs are laid singly or in small clusters on the leaves. They are spherical, transparent, with a yellow tinge, and hatch in summer in four days. The cast mite skins adhere, as stated above, to the surface of leaf or fruit. The food of the mite is the essential oil which abounds in the succulent parts of citrus plants. It is stationary when feeding, but moves actively, and wanders from one part of the plant to another, especially to new growths. Thousands occur on a single leaf, 75,000 having been computed by Mr. Hubbard in winter time on a leaf averaging fifteen square inches. They are still more numerous in summer.

Rust rings encircle the fruit much as the ecliptic does the earth. There is a penumbral band between brightest sun and deepest shade, indicating the preference of the mite for such half shade. Frosts kill the mites, but not the eggs. Drouth causes both to dry up. Birds, insects, and especially spiders, are the chief agencies in distributing the mites from place to place. The effect of the mite on the fruit, aside from the rusty appearance, which lowers the market value, is in nowise injurious, as the quality is, if anything, improved, and the disposition to rot decreased. The effect on the leaf is to slightly check growth.

The mite is generally distributed in Florida, but not elsewhere. Like most mites affecting growing plants, it is worse on high, dry lands than in low, moist ones.

No method of culture or of manuring—in fact, no method that does not comprehend the true cause, has proved of avail to prevent the rust. Wind-breaks and isolation act as preventives, but insecticides are the only remedial agencies; they must, however, kill mites, *eggs*, and *molting* mites. Whale oil soap, one pound to five gallons of water, in early spring before new growth begins, and weaker solutions at frequent intervals, cause the mites to fall to the ground. *Flowers of sulphur* is deadly to the active mites, but not to the eggs. Kerosene emulsions, as used against scale-insects, with sulphur added, are the most satisfactory.

Dr. E. P. Howland read a paper on THE EFFECT OF ANÆSTHETICS ON ANIMALS, explaining the new invention of Paul Bert.

Sixty-Second Meeting, April 19, 1884.

The President occupied the chair. Forty members were present.

Dr. Cyrus Thomas read a paper on The Growth of Trees as a Means of Determining the Age of Mounds. The long accepted theory that the age of a tree is indicated by the number of concentric rings can no longer be considered tenable. The only way of testing this theory is by cutting down trees the age of which is known. This has been done in many instances, which were cited, and the result has been the demonstration of the falsity of the long accepted theory.

Mr. John Murdoch made remarks on Dredging and Marine Collecting at Point Barrow, detailing his experiences as naturalist of the Signal Service Station at that place.

Dr. Bean, in a paper on The Distribution of the Salmonidæ in Alaska, enumerated the following twenty-one salmonoids as occurring there:

Osmerus dentex, *Osmerus spirinchus*, *Mallotus villosus*, *Hypomesus olidus*, *Hypomesus pretiosus*, *Thaleichthys pacificus*, *Thymallus signifer*, *Stenodus Mackenzii*, *Coregonus Laurettæ*, *Coregonus* near *Merkii*, *Coregonus quadrilateralis*, *Coregonus Kennicottii*, *Coregonus Nelsonii*, *Salvelinus malma*, *Salmo purpuratus*, *Salmo Gairdnerii*, *Oncorhynchus chouicha*, *Oncorhynchus keta*, *Oncorhynchus nerka*, *Oncorhynchus kisutch*, *Oncorhynchus gorbuscha*.

Osmerus is known to range only from the Bristol Bay region to the extreme northern limit of the Territory. *O. dentex* is quite similar in appearance to *O. eperlanus* and *O. mordax* of the Atlantic. *O. spirinchus* may be simply the spent condition of *dentex*. In the region in which they occur the smelts are quite abundant, and are extensively used by the natives for food, both fresh and dried.

Mallotus villosus is found in every portion of the Territory, being extensively eaten by the natives, and forming one of the best known foods for the codfish in the Gulf of Alaska.

Hypomesus is represented by two species, one of which, *H. olidus*, is confined to the western shore of Alaska, being most abundant to the northward. *H. pretiosus* is known only from the Gulf of Alaska. *H. olidus* spawns in fresh-water ponds, while *H. pretiosus* is a surf spawner.

Thalcichthys pacificus (the Eulachon) occurs in the Gulf of Alaska at least as far west as Katmai, in Shellikoff Straits, where it is preserved in salt and considered quite a delicacy. The Eulachon literally swarms in the southeastern part of the Territory, and is utilized both in a fresh state and for the manufacture of a fat or oil which the natives use in place of butter, and which has been experimented with as a substitute for cod liver oil.

Thymallus is known to occur from the Bristol Bay region to the extreme northern limit of the Territory, abounding in the rapid rivers. It takes the artificial fly quite readily, according to the testimony of Lieut. Schwatka, and is generally considered an excellent food-fish. To the eastward it is known to reach the Mackenzie river region.

Stenodus might be called the giant white fish. It reaches 50 pounds in weight, and has been recorded as growing to a length of 5 feet. We have it only from the Yukon river region. It was described, however, from the Mackenzie, and occurs also in the tributaries of that river. It is one of the finest food-fishes of Alaska.

The most widely distributed of the species of *Coregonus* is *C. quadrilateralis*, which we now have from the Yukon river region southward to Kodiak. *C. Laurettæ* is also pretty widely distributed, at least from the Kuskoquim to Point Barrow. The species related to *C. Merkii* is a small northern form, which is not of much importance as a food-fish. *C. Nelsonii* is a hump-back species, not important as a food-fish, ranging from the northern limit of the Territory southward to the Yukon, at least, and probably to the Kuskoquim. *C. Kennicottii* ranks next in excellence to *Stenodus*. It is said to reach 30 pounds in weight, and its range is from the Kuskoquim to the northern limit of Alaska. All the *Coregoni* are important for food except *C. Nelsonii* and *C. Merkii*, sub-species.

Salvelinus is abundant throughout the Aleutians and the mainland of Alaska, north to Colville river. In the northern portion of its range it grows to an enormous size, reaching fully 12 pounds in weight. In the sea-run condition it is extensively salted at Kodiak, and exported as salmon trout.

Salmo purpuratus is found in southern Alaska and on the island of Kodiak and Unalashka. It is extremely abundant and attains a weight of 20 pounds. *S. Gairdnerii* occurs in southern Alaska and

westward to the Bristol Bay region. It is also known from the islands of Unalashka and Kodiak. It grows to a weight of 30 pounds, and is a very important food-fish.

One species of *Onchorhyncus*, *O. gorbuscha*, extends over the whole coast of Alaska northward to Colville river. All the rest extend at least as far as the Yukon river, and one species, *O. keta*, has been obtained from Hotham Inlet. The *Onchorhynchi* are the most important food-fishes of the Territory, and are the most abundant. The principal centers of export are Kodiak and Cook's Inlet.

Numerous canneries have sprung up lately in these regions, directing their attention mainly to the red-fish, *O. nerka*, a salmon whose flesh is beautifully red, but comparatively inferior. The finest of the salmon, *O. chouicha*, is employed principally for salting, the bellies only being selected for this purpose; the remainder of the fish is made into *ukali*.

Sixty-Third Meeting, May 3, 1884.

The President occupied the chair. Twenty members were present.

Prof. Theodore Gill read a paper On the System of the Squali. These belong to the Selachians, which constitute a class quite distinct from the fishes and widely separated from the Ganoids. He briefly reviewed the salient structural features of the various representatives of the order Squali, as well as the history of the classification of the group, and concluded with the assertion that there appeared to be five principal types of structure manifested in the various forms whose anatomy is more or less satisfactorily known.

(1.) The Pternodonta or Selachophichthyoidei are represented by but one known species, lately described by Mr. Garman. Its anatomical characteristics are unknown, but will probably be found to be nearly the same as in the succeeding group, Opistharthri. It is distinguished from all other known sharks by the very elongated and almost anguilliform shape as well as by the peculiar teeth, which have long fixed bases and are not reclinable as in most of the other types. It was also predicted that the Pternodonta would probably be found to have the palato-quadrate element articulated

with the posterior portion of the skull behind the orbits, and the vertebral column non-segmented or notochordal.

(2.) The Opistharthri are sharks with the palato-quadrate apparatus articulated with the post-orbital processes of the skull, and a persistent notochord, inferior mouth, and the branchial apertures in increased numbers. The Notidanidæ or Hexanchidæ are the only forms.

(3.) The Proarthri are sharks with the palato-quadrate apparatus articulated with the anterior orbital region of the skull, the vertebral column segmented, the mouth sub-terminal, and the forehead declivous. The Heterodontidæ, represented by the well-known "Port Jackson Shark," form the only existing family.

(4.) The Anarthri are sharks with the palato-quadrate apparatus not articulated directly with the skull, the vertebral column variable but more or less segmented, and the mouth inferior. To this group belong all living sharks, excepting those now specifically eliminated.

(5.) The Rhinæ are sharks with the palato-quadrate apparatus also not directly articulated with the skull, the vertebral column segmented, the mouth terminal (both jaws being advanced well forwards), and the pectorals developing enlarged anterior basal lobes which are separated by notch-like spaces from the branchial regions. To this belongs the family Squatinidæ, including the so-called angel-sharks.

The speaker was inclined to consider several of these more than sub-ordinal, and rather as of ordinal, value, but until they had been better studied he would reserve opinion on this question. He would now only add that the first and second groups might be combined in one order, the third isolated in another, and the fourth and fifth segregated in a third.

There was also one type represented by the extinct Cladodontidæ, whose position is doubtful. For these he had formed the group Lipospondyli, but it is not evident whether it belongs with the true Squali or whether it may not be related to the Holocephali, the character of the branchial arches being dubious.

Mr. N. P. Scudder read a paper on CERTAIN ANATOMICAL DETAILS IN THE MUSKRAT, and exhibited specimens of the skeletons of muskrats, showing the number of the lumbar vertebræ to be six and not three as stated by Professor Flower. He also showed that

the malar bone formed part of the continuity of the zygomatic arch, correcting the statement of Dr. Coues in his "Monograph of American Rodentia," page 253, with regard to the jugal of the muskrat, which is there described as "a mere splint, not forming by itself any part of the continuity of the arch, for the squamosal and maxillary spurs are absolutely in contact. This is a strong point of Fiber." Mr. Scudder remarked that muskrats were able to live four to six minutes under water, owing probably to the enlargement of the abdominal aorta. He believed muskrats to be omnivorous, and said that the same individual could be taken repeatedly in the same trap.

Dr. R. W. Shufeldt made a communication UPON THE PRESENCE OF RIBS ATTACHED TO THE OCCIPITAL BONE OF THE BLACK BASS, MICROPTERUS SALMOIDES.* He remarked, in the course of his description, that he had recently made quite a number of dissections of this fish, and in every instance had found a pair of ribs upon the occipital bone, just above and internal to the foramen of the vagus nerve. They are without epipleural appendages, but otherwise like the abdominal ribs. If this fact be new to science, it is a very interesting discovery of great morphological significance, and introduced an important factor in the theory of the segmentation of the skull. It had not been noticed in any of the prominent works upon comparative anatomy generally used as text-books, nor in a recent and very thorough article by Dr. Sagemehl upon the cranial osteology of *Amia calva* (Morph. Jahrb., Vol. 9, pt. 2, 1883). Dr. Shufeldt had also discovered these ribs, thoroughly developed, in the tunny, *Orcynus thynnus*, and thought that they would doubtless be found in others of the *Scombridæ* and *Centrarchidæ*.

SIXTY-FOURTH MEETING, May 17, 1884.

Prof. C. V. Riley, Vice-President, occupied the chair. Thirty-five members were present.

Dr. J. M. Flint, in a paper on CHINESE MEDICINES, after giving

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* 1884. SHUFELDT, R. W. Osteology of the Large-mouthed Black Bass (*Micropterus salmoides*). <Science, III, p. 532, 1884.

a brief account of the history of medicine among the Chinese, according to their own authors, discussed their theories in regard to the nature and causes of disease and the action of remedies. Their ignorance of anatomy and the consequent effects upon their theory and practice was shown. The materia medica of the Chinese was then considered in detail, its peculiarities, as well as its resemblances to our own, present and past, as illustrated by the collections of Chinese drugs now in the possession of the U. S. National Museum.

A paper by Mr. Wiley Britton on the BUFFALO GNAT OF TENNESSEE was read, in which the author stated that its habitat, in his opinion, was confined to the Mississippi Valley, below the mouth of the Ohio river. It generally makes its appearance about the first of April, and remains from two to four weeks; it destroys annually considerable numbers of live-stock, particularly mules and horses, which, however, could be protected by thorough greasing. The bite of this gnat is poisonous, causing a swelling somewhat like a bee sting. Prof. C. V. Riley stated that this gnat is a species of *Simulium*.

Dr. Bean read a paper entitled THE WHITE FISHES OF NORTH AMERICA.* The speaker said there were twelve species indigenous to North America, besides the "Inconnu," which is not properly a white-fish, though related to it. He introduced into the list *Coregonus lavaretus*, the German "Maræna." He made a few general remarks concerning the wide distribution, great abundance, and importance of the white fishes as food, and stated the range of each species, its maximum size and weight, and its variations through age and conditions of habitat. A brief key to the species, intended to facilitate their speedy identification, and based upon natural characters only, was included in the paper.

Dr. Thomas Taylor exhibited a new micrometer of his own invention for measuring accurately and instantly to the 1-2000 inch the thickness of any object. In a second communication he stated that Pseudo Bacteria were produced by the heating of blood at a comparatively low temperature, and proposed to make experiments for the purpose of deciding whether a continuous fever of four or

* 1884. BEAN, TARLETON H. The White Fishes of North America. <Trans. Amer. Fish Cultural Association, 13th meeting, 1884, pp. 32–39.

five days with the blood at 104° F. would produce the same results as blood artificially heated to 110° F. If so, it would account for mistakes that have been made by persons inexperienced in examining the blood of fever patients, who reported the presence of Bacteria, or broken blood corpuscles, as shown by Beal and others. Dr. Taylor also explained a method of obtaining upon a screen an apparent image of a microscopic object, by placing the microscope horizontally and at right angles to the screen. While looking through the microscope with one eye, the other is directed toward the screen, upon which an image becomes apparent, its magnification depending upon the distance of the observer from the screen.

Sixty-Fifth Meeting, May 31, 1884.

The President occupied the chair. Thirty members were present.

Prof. L. F. Ward, Chairman of the Committee on Cultivated Plants growing in the District of Columbia, submitted a report of progress.

Mr. James E. Benedict made Remarks on the Recent Cruise of the Steamer "Albatross" in the Gulf of Mexico and the Caribbean Sea, describing the events of the voyage, and exhibiting some of the most remarkable objects collected.

Ensign E. E. Hayden, U. S. N., presented, through Prof. Ward, a paper on A New Method of Figuring Fossil Leaves and other Objects by the aid of Photography,* remarking that a saving of time and increase of accuracy was thereby attained. The method consisted in drawing with India ink upon a silver print photograph the outline of the object to be figured, the defects of the photograph being supplied by the draughtsman through comparison with the specimen. The photograph is then dismissed, and a photo-engraving is made from the black lines of the sketch which remains.

In the discussion which followed, it was shown that this process was novel in its successful application by the author to engrave fossil leaves.

Mr. J. A. Ryder read a paper on The Development of Vivipa-

rous Minnows.* The species under discussion was the form known as *Gambusia patruelis*, B. & G. The points which were especially alluded to were the following: The fact that the young fish developed within the body of the female parent and within the follicles in which the eggs themselves were developed. It was also pointed out that these follicles, which were covered with a rich net-work of fine capillary vessels, assumed the office of a respiratory apparatus, by which the gases were interchanged between the embryo and the parent fish; and, further, that this follicle also acted as an egg membrane, being actually perforated by a round opening, which the speaker termed the "follicular pore," and which was analogous to the micropyle of the ordinary fish egg. The arrangement of the follicles of the ovary within the body of the female was described at some length, and the peculiar differences between the two sexes in the arrangement of the viscera were pointed out. The fibrous bands, which act as supports, or stays, to the basal portion of the anal fin of the male, which is modified as an intromittent organ, were also described. The great difference in the sizes of the sexes was also referred to, the female weighing over six times as much as the male. The speaker concluded by expressing his earnest desire to investigate the other known forms of viviparous fishes, such as the Embiotocoids of the West coast, the viviparous Blenny, and other bony fishes which have this habit, and which, in his opinion, would throw considerable light upon some of the peculiar physiological processes involved in the viviparous methods of development.

Mr. Romyn Hitchcock exhibited a collection of Foraminifera belonging to the genus *Lagena*, and made a few remarks explaining the relation between this genus and the Nodosarine group; these briefly being that *Lagena* may be taken as the type of the group, passing through *Nodosaria* and ending in *Cristellaria* as the most complete manifestation of its method of growth.

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* 1882. Ryder, John A. Structure and ovarian incubation of *Gambusia patruelis*, a top-minnow. <American Naturalist, Feb., 1882, pp. 109–118.

ADDRESSES AND COMMUNICATIONS.

THE PRINCIPLES OF ZOOGEOGRAPHY.*

By Theodore Gill.

Zoogeography, or the science of the geographical distribution of animals, may be said to have originated with the illustrious French naturalist of the last century, who inaugurated the era of philosophical zoology in about the same degree as Linnæus did that of systematic zoology, and who is also well known as the antagonist and rival of the great Swede. Many of the facts that are the bases of its propositions had indeed been known before the time of Buffon, but the relations of those facts to each other, and to the general doctrine of science, had either been entirely overlooked or were vaguely appreciated.

It is Buffon who is to be credited with having first promulgated precise generalizations respecting the geographical distribution of animals. Buffon, in this respect, not only advanced much beyond his predecessors, but leaped at once to a position which some of the the more pretentious naturalists of our own times have failed to attain. In brief, he recognized (1) that the inhabitants of the tropical and southern portions of the old and new worlds were entirely different from each other; (2) that those of the northern portions of the two were, to a considerable extent, identical; and

*Annual presidential address delivered at the Third Anniversary Meeting of the Society, January 19, 1883, in the lecture room of the U. S. National Museum.

In the present address, previous contributions by the author to Zoogeography—the article "Zoological Geography" in Johnson's New Universal Cyclopædia, and a review of Wallace's "Geographical Distribution of Animals," published in "The Nation" for July 12 and 19, 1877, and republished in "Field and Forest," (vol. iii, pp. 69-74, 78-80, 98-101,) have been borrowed from.

(3) that the confluence of the two was most apparent towards the proximate portions of America and Asia. The truth that animals in fact had, for the most part, originated in the regions of the earth where they are now found, became incontrovertible; and geological research demonstrated that they were preceded by forms which were the ancestors of those now living on the soil. Numerous zoologists from time to time took up the problem of the distribution of animals as a special study.

But it is not incumbent on us at present to enter into a discussion of the steps in our knowledge of the geographical distribution of animals. It will now be sufficient to glance at two of the latest and rival propositions for the partition of the globe into those primary zoogeographical divisions, which, in furtherance of an analogy seized upon by the late Professor Agassiz, in his designation of a well known portion of North America as the "Zoological island of New England," may be figuratively called *Zoological Continents*. The great divisions of this rank have been termed by many American naturalists "realms," and by English writers "regions."

Mr. Alfred Russel Wallace, in his thoughtful work on "The Geographical Distribution of Animals,"* published in 1876, has recognized six primary zoogeographical divisions of the globe, which he has named regions, and, accepting views current in England, has designated and constituted as follows:

I. Palæarctic region, with four sub-regions:
   1. North Europe.
   2. Mediterranean, or South Europe.
   3. Siberia.
   4. Manchuria, or Japan.

II. Ethiopian region, with four sub-regions:
   1. East Africa.
   2. West Africa.
   3. South Africa.
   4. Madagascar.

* Vol. i, pp. 81, 82.

III. Oriental region, with four sub-regions:
   1. Hindostan, or Central India.
   2. Ceylon.
   3. Indo-China, or Himalayas.
   4. Indo-Malaya.

IV. Australian region, with four sub-regions:
   1. Austro-Malaya.
   2. Australia.
   3. Polynesia.
   4. New Zealand.

V. Neotropical region, with four sub-regions:
   1. Chili, or South Temp. America.
   2. Brazil.
   3. Mexico, or Tropical North America.
   4. Antilles.

VI. Nearctic region, with four sub-regions:
   1. California.
   2. Rocky Mountains.
   3. Alleghanies, or East United States.
   4. Canada.

A corresponding member of this Society, and one of the most learned and thorough of American naturalists, Mr. J. A. Allen, in an elaborate memoir on "The Geographical Distribution of the Mammalia, considered in relation to the principal ontological regions of the earth, and the laws that govern the distribution of animal life,"* published in 1878, has proposed a very different subdivision. He recognized three categories of general areas—viz: (1) "primary divisions or 'realms,'" (2) "secondary divisions or 'regions,'" and (3) "divisions of third rank or 'provinces.'" The several categories have been denominated as follows:

I. An Arctic, or North Circumpolar realm.

* Bulletin U. S. Geological Survey, vol. iv, p. 376.

II. A North Temperate realm, with two regions, viz:
  1. American, with four provinces:
    a. Boreal.
    b. Eastern.
    c. Middle.
    d. Western.
  2. Europæo-Asiatic, with four provinces:
    a. European.
    b. Siberian.
    c. Mediterranean.
    d. Manchurian.

III. An American Tropical realm, with three regions, viz.:
  1. Antillean.
  2. Central American.
  3. Brazilian.

IV. An Indo-African realm, with two regions, viz:
  1. African, with three provinces:
    a Eastern.
    b. Western.
    c. Southern.
  2. Indian, with two provinces:
    a. Continental.
    b. Insular.

V. A South American Temperate realm, with two provinces, viz:
    a. Andean.
    b. Pampean.

VI. An Australian realm, with three regions, viz:
  1. Australian, with two provinces:
    a. Australian.
    b. Papuan.
  2. Polynesian.
  3. New Zealand.

VII. A Lemurian realm (undivided).

VIII. An Antarctic or South Circumpolar realm.

On a comparison of the respective schemes of Messrs. Wallace and Allen, it is obvious that they must have been influenced by quite different considerations. Not one of the primary regions of the two authors is accepted with the same limits by both, and sometimes they differ radically. Mr. Allen recognizes as a peculiar realm (the "Arctic realm") a division which is considered neutral territory belonging to the Palæarctic and Nearctic regions by Mr. Wallace; he degrades the Indian and African realms to subdivisions of a common *Indo-African realm*, but subtracts from the former the Malagasy region to raise it to the rank of an independent realm—the Lemurian—co-equal with the Indo-African. He further adds, a *South American temperate realm* and an *Antarctic realm*. The examination and analysis of the evidence which has led to such different results will be instructive and lead up to some interesting deductions. We may aptly commence this examination by a glance at the several "realms" concerning which there is an approximate agreement. But the premises upon which Messrs. Wallace and Allen have worked should be first stated.

The conception of Mr. Wallace as to the character of the primary zoogeographical regions or zoological continents is, that "it is a positive, and by no means an unimportant, advantage to have our named regions approximately equal in size, and with easily defined, and therefore easily remembered, boundaries," providing that "we do not violate any clear affinities or produce any glaring irregularities." It is further claimed that "all elaborate definitions of interpenetrating frontiers, as well as regions extending over three-fourths of the land surface of the globe, and including places which are the antipodes of each other, would be most inconvenient, even if there were not such difference of opinion about them."*

Again, Mr. Wallace says: "On two main points every system yet proposed, or that probably can be proposed, is open to objection; they are,—1stly, that the several regions are not of equal rank;—2ndly, that they are not equally applicable to all classes of

*Wallace, Geog. Dist. Anim., vol. i, pp. 63, 64.

animals. As to the first objection, it will be found impossible to form any three or more regions each of which differs from the rest in an equal degree or in the same manner. One will surpass all others in the possession of peculiar families; another will have many characteristic genera; while a third will be mainly distinguished by negative characters. There will also be found many intermediate districts, which possess some of the characteristics of two well-marked regions, with a few special features of their own, or perhaps with none; and it will be a difficult question to decide in all cases which region should possess the doubtful territory, or whether it should be formed into a primary region itself."*

As to the question "Which class of animals is of most importance in determining Zoological Regions," Mr. Wallace thinks that we should "construct our typical or standard Zoological Regions in the first place, from a consideration of the distribution of mammalia, only bringing to our aid the distribution of other groups to determine doubtful points. Regions so established will be most closely in accordance with those long-enduring features of physical geography, on which the distribution of all forms of life fundamentally depends; and all discrepancies in the distribution of other classes of animals must be capable of being explained, either by their exceptional means of dispersion or by special conditions affecting their perpetuation and increase in each locality." "If these considerations are well founded," he continues, "the objections of those who study insects or molluscs,—for example, that our regions are not true for their departments of nature,—cannot be maintained. For they will find, that a careful consideration of the exceptional means of dispersal and conditions of existence of each group, will explain most of the divergences from the normal distribution of higher animals."†

Mr. Allen recalls that he had in 1871 "claimed, in accordance with the views of Humboldt, Wagner, Dana, Agassiz, DeCandolle, and others, that life is distributed in circumpolar zones which con-

* Wallace, Geog. Dist. Anim., vol. i. p. 53.

† Wallace, op. cit., vol. i, p. 57.

form with the climatic zones, though not always with the parallels of the geographer."

Mr. Allen contends* that—

"In fact, so generally is temperature recognized by the leading writers on the distribution of marine life that it seems superfluous to reiterate or emphasize this principle. That the zones of life should be perhaps a little less obvious over the land areas—in consequence of the diversity of contour resulting from differences of elevation, and the interruptions and exceptional conditions due to mountain chains and high plateaus—than over the oceanic expanses, is naturally to be expected. That there is, however, a similar correspondence between climatic belts and the zones of life seems to me abundantly evident. As has been already shown, the broader or primary zones are, first, an Arctic or North Circumpolar Zone, embracing the arctic, subarctic, and colder temperate latitudes of the northern hemisphere, throughout the whole of which area there is a marked homogeneity of mammalian life, as well as of animal and vegetable life in general; secondly, that below this there is a broad belt of life, which, in its general *facies*, is distinctive of the temperate and warm-temperate latitudes, and that these two zones of life are far more closely related *inter se* than with the life of the intertropical regions, with which regions they may be collectively contrasted, and together receive the appropriate name of '*Arctogæa*;' thirdly, it has been shown, so far as the northern hemisphere is concerned, that the life of the tropical and temperate regions of the same continent is more widely different than is the life of corresponding portions of the temperate and colder parts of the (so-called) Old World and the New; fourthly, that the life of Tropical America has very little in common with that of the tropical portions of Asia and Africa; fifthly, that the life of the South Temperate Zone presents a *facies* distinct from that of the tropics, and has still less in common with that of the North Temperate Zone; sixthly, that Australasia is so highly differentiated as to form a distinct primary region, having little in common with other lands, even with those of contiguous regions, or those having a similar geographical position; seventhly, that Madagascar and its contiguous islands, while to some extent African in affinity, form also a highly specialized region; lastly, that the antarctic and cold south-

* Allen, op. cit., pp. 373–375.

temperate oceanic regions are recognizable as a primary region, characterized by a peculiar general *facies* of life, that more strongly recalls that of the corresponding portions of the northern hemisphere than of any other portion of the earth. It has been further shown that the Australian Realm is divisible into temperate and tropical portions, and also that the land surface is separable into zones of even still narrower limits, corresponding in a general way with those recognized by Dana for marine life.

"The almost total absence of identical genera, or even of families, excepting such as are essentially cosmopolitan, in the American and Old World tropics, as well as the distinctness of the Lemurian Realm, and the almost total isolation of the Australian Realm, evidently require for their explanation other causes than merely the existing climates. The geological history of these land-areas and their faunæ must be of course considered in order to understand their present relationships. As the northern hemisphere at present most clearly shows, nearly continuous land surface and similarity of climatic conditions implies identity of fauna, while isolation, especially when joined with diverse climatic conditions, implies diversity of life, and a differentiation proportionate to the degree of isolation, and the length of time such isolation has existed; in other words, that the present want of affinity between the life of the Lemurian and Australian Realms and that of the rest of the world is due rather to their long geographical isolation than to present climatic conditions, and that we here find, for reasons perhaps not wholly apparent, the remnants of a somewhat primitive or early fauna that was formerly shared more largely by other areas than at present—that these regions became isolated before the development of many of the higher and now prevalent types of the larger and more diversified land-areas, and that here differentiation has proceeded less rapidly and along fewer and narrower lines than elsewhere; furthermore, that the present highly diversified fauna of the chief tropical areas, in comparison with the fauna of the north-circumpolar lands, is due in part to the southward migration, near the close of the Tertiary period, of forms adapted to a high temperature, and in part to the high rate of differentiation favored by tropical conditions of climate. Hence, given: 1. Arctic and cold-temperate conditions of climate, and we have a fauna only slightly or moderately diversified; 2. A moderate increase of temperature, giving warm-temperate conditions of climate, and we have the addition of

many new types of life; 3. A high increase of temperature, giving tropical conditions of climate, and we have a rapid multiplication of new forms and a maximum of differentiation. Again, given: 1. A long-continued continuity of land surface, and we have an essential identity of fauna; 2. A divergence and partial isolation of land-areas, and we find a moderate but decided differentiation of faunæ; 3. A total isolation of land-areas, and we have a thorough and radical differentiation of faunæ, proportioned to the length of time the isolation has continued. Hence, the present diversity of life is correlated with two fundamental conditions: 1. Continuity or isolation, past as well as present, of land surface; and, 2. Climatic conditions, as determined mainly by temperature."

Without further comment, we will proceed to the consideration (1) of the several regions concerning which there is proximate agreement, and (2) next to those in dispute.

THE NORTH AMERICAN TEMPERATE REALM OR NEARCTIC REGION.

It is with its widest limits that this territory has been admitted by Mr. Wallace, while by Mr. Allen it is deprived of the Arctic region, which has been associated with the isothermal portion of the Eurasia to constitute together an Arctic realm. This will be the subject of consideration hereafter. Issue has also been joined as to the southern limits of the realm and as to the pertinence or non-pertinence to it of the Sonoran and Lower Californian "regions" of Cope, but this is a question of detail which need not detain us at the present time.

THE EUROPÆO-ASIATIC OR PALÆARCTIC REALM.

The only serious point at issue between Messrs. Wallace and Allen affecting this realm is whether the Arctic portion is, or is not, an integer, Mr. Wallace including it and Mr. Allen excluding and uniting it with the American Arctic, and considering the two as the components of a "realm," as will be hereafter seen.

It will be now in order to inquire into the tenability of the other realms whose adoption has been urged by Mr. Allen. These are

the Arctic, the Indo-African, the Lemurian, the South American Temperate, and the Antarctic.

THE ARCTIC REALM.

Mr. Allen gives the following reasons for retention of this realm:

"Whether or not an Arctic Region should be recognized as a division of the first rank is a question not easy to satisfactorily answer. Naturalists who have made the distribution of animal life in the boreal regions a subject of special study very generally agree in the recognition of a hyperboreal or circumpolar fauna, extending in some cases far southward over the Temperate Zone. The Arctic portion of this hyperborean region has been frequently set off as a secondary division, or sub-region, and generally recognized as possessing many features not shared by the contiguous region to the southward. For the present I prefer to still retain it as a division of the first rank. It is characterized mainly by the paucity of its life, as compared with every region except the Antarctic, and by what it has not rather than by the possession of peculiar species or groups. It wholly lacks both Amphibian and Reptilian life, is almost exclusively the summer home of many birds, and forms the habitat of the Esquimaux, the Arctic Fox, the Polar Bear, the Musk Ox, the Polar Hare, the Lemmings, the Walruses, the Narwhal, and the White Whale, which are confined within it. It has no *Chiroptera* nor *Insectivora*, two or three species of Shrews, however, barely reaching its southern border. It shares with the cold-temperate belt the presence of the Moose and the Reindeer, several Pinnipeds, a number of boreal species of *Glires*, several fur-bearing *Carnivora*, and a considerable number of birds. Its southern boundary may be considered as coinciding very nearly with the northern limit of arboreal vegetation, and hence approximately with the isotherm of 32° F. Its more characteristic terrestrial forms range throughout its extent, none being restricted to either the North American or Europæo-Asiatic continent. Hence it is indivisible into regions of the second and third grades (regions and provinces,) and may be considered as embracing a single hyperborean assemblage of life."

It cannot be overlooked that the reasons thus urged are very unsatisfactory, and result in part from the confusion of inland and marine faunæ under the same category. The seals, walruses, and

cetaceans are not terrestrial mammals, but marine, and their distribution is governed by the same laws which affect marine animals generally. The very few peculiar species, except the musk ox, are but little modified relations of forms common to the adjoining realms, and the absence of most forms is evidently dependent on the cold climate, and furnishes no more reason for assigning a primary rank to the territory so characterized than it would to the mountain peaks and deserts so frequently isolated in the midst of the adjoining regions, and which are equally distinguished by the paucity of their animal life. The fact that it cannot be distinctly relegated to either the North American or Eurasian realms, but is neutral territory, is scarcely sufficient to warrant its entire isolation from both.

The next disputed question involves the union or distinction of the Indian and African territories. The question is thus discussed by Mr. Allen.

INDO–AFRICAN REALM.

According to Mr. Allen, "The Indo-African Realm consists mainly of Intertropical Africa and Intertropical Asia, to which it seems proper to add Extratropical South Africa. The small portion of Africa south of the Southern Tropic lies wholly within the warm-temperate zone. Its small extent and broad connection with Tropical Africa render its separation as a distinct realm (as I at one time rather hastily considered it) almost inadmissible, since it is especially open to the influence of the great intertropical African fauna, as is shown by the extension of many tropical forms down to within a few degrees of its southern extremity. The area really possessing a temperate climate is restricted to its extreme southern border, where alone appear the few generic and family types that do not have a very general range over the tropical portions of the continent. This area is many times smaller than the temperate portion of South America, but, though so small, has quite a number of peculiar genera, which impart to it quite distinctive features. It yet seems better to regard it as an appendage of the great Indo-African Realm rather than as a distinct primary region. Madagascar, with the Mascarene Islands, on the other hand, while perhaps possessing a closer affinity with Africa than with any other conti-

nental region, has yet a fauna made up so largely of peculiar types that it seems more in accordance with the facts of distribution to regard it as a separate primary region.

"The Indo-African Realm, as thus restricted, forms a highly natural division. Although its two principal areas are quite widely separated, being in fact geographically almost wholly disassociated, they possess a wonderful degree of similarity. Of the fifty commonly recognized families of mammalia occurring within its limits, three-fifths are distributed throughout almost its whole extent. Of the remainder, one-half are confined to Africa, and one is African and American, leaving only nine in India that are unrepresented in Africa; three only of these latter are, however, peculiar to the Indian Region; all extend beyond it to the northward, five of them even occurring over the greater part of the northern hemisphere. Thus the African region is the more specialized division, only a small portion of the tropical element in the Indian Region, through which it is differentiated from the great Europæo-Asiatic Temperate Region, being unrepresented in the African, while the African has three times as many peculiar families as the Indian."

I am quite unable to appreciate the force of this exposition as an argument in favor of the union of the two regions; it appears to me that it is, indeed, one that tells for the contrary side. Let it be recalled that the ten families* peculiar to the African region are very distinct, and that almost all of the eighteen families "common to both regions" can be added to the twelve "of wide extralimital range," if we take into consideration their distribution in even newer Tertiary or sometimes Quaternary times. Further, the genera even were, for the most part, of wide distribution formerly, and there is strong reason to believe that the thirty forms "common to both regions" were invaders of Africa in the later Tertiary, and that among those now "peculiar to the African region" we have the remnants of older faunæ. If we revert to the fishes we find some striking facts. These can be resolved under two categories. On the one hand a number of forms are peculiar to Africa, or shared in common with South America; on the other are certain genera

* There are really more.

shared in common with Asia, or very closely related to Asiatic forms, and well fitted for extension of their range by tenacity of life or adaptation for limited ærial respiration. The evidence here again leads to the conclusion that the peculiar types are derived from very ancient tenants of the territory, while those common to Asia are of recent introduction. We must of course take cognizance of these contrary indications in our appreciation of the relations of the respective regions, and not allow ourselves to be unduly influenced by the predominance of the recent invaders. Africa is a decidedly distinct region so far as its aboriginal population is concerned. Further, its relations, as indicated by its primitive and more characteristic types, are with South America rather than with India, as I shall hereafter show.

THE LEMURIAN OR MALAGASY REALM.

Whether the Malagasy region or *Lemurian realm* of Allen is independent or an appanage of the African, is the question naturally next in order.

According to Mr. Allen, "As was long since claimed by Dr. Sclater,* Madagascar is faunally so distinct from every other ontological division of the globe as to be entitled to the rank of a primary zoogeographical region. With it, as is generally admitted, should be associated the Mascarene Islands. The very few mammals indigenous to these islands are decidedly Madagascarine in their affinities, as are the birds and other land animals. While the Lemurian fauna shows decided African affinities, it is second only to the Australian in its degree of specialization. It departs most strikingly from all other regions in what it lacks, through the absence of all Carnivores save one peculiar family (*Cryptoproctidæ*), represented by a single species, and four peculiar genera of the family *Viverridæ;* of all Ruminants and Proboscidians; all Pachyderms, except a single African genus of *Suidæ;* and all Rodents, except a few species of *Muridæ*. The Insectivores are almost wholly represented by one or two species of *Crocidura*, and a family, embracing several genera, not found elsewhere, save a single genus in

* Quart. Journ. Sci., vol. i, April, 1864, pp. 213-219 (Allen).

the West Indies. Four families of Bats occur, but are represented, with one exception, by a single species each. They belong to groups of semi-cosmopolitan range, and owing also to the exceptional means of dispersal possessed by the *Chiroptera*, have little weight in determining the affinities of the fauna. The Quadrumanes are represented only by the *Prosimiæ*, of which three-fourths of all the species occur here, while about four-fifths of the remainder are African. The remains of an extinct species of *Hippopotamus* have been found, a type existing at present only in Africa. Although the Indian genus *Viverricula* has recently been established as occurring in Madagascar, the few types that connect the Lemurian mammalian fauna with the faunæ of other parts of the world are preponderatingly African."

There is much that could be said on both sides of this question, thus ably discussed. When, however, we recall the fact, lately urged, that most of the types that now characterize Africa are comparatively recent immigrants into that continent; that the nearest existing allies of the peculiar mammalian types of Madagascar are to be found among the older types of Africa, and that the few fresh-water fishes of Madagascar are of a decided African type, the divergences of the two are materially lessened; there is no dispute that the relations of the Malagasy fauna are most intimate with Africa, and as the question of the distinction of the former from the latter is at least doubtful, and must remain so until its fauna is better known and has been more thoroughly analyzed, we may, provisionally, at least, consider the one as an appanage of the other, having not much less perceptible relations to the main portion than does the Antillean to the South American.

THE SOUTH AMERICAN TEMPERATE REALM.

In Mr. Allen's words, "What is here termed the South American Temperate Realm embraces all that portion of the South American continent and adjacent islands not included in the American Tropical Realm as already defined. It coincides very nearly with Mr. Wallace's 'South Temperate American or Chilian Sub-region.'*

* Geog. Dist. Animals, vol. ii, p. 36, and map of the Neotropical Region.

Its northern limit on the Atlantic coast is near the thirtieth parallel. On leaving the Atlantic coast, the northern boundary passes obliquely northwestward, rising in the region of the Chaco Desert, to, or possibly a little beyond, the Tropic of Capricorn. Again, descending to about the twenty-fifth parallel, it turns abruptly northward and eastward, along the eastern border of the Andean chain, nearly to the fifth degree of south latitude, near which point it strikes the Pacific coast. It thus embraces a large part of the great Andean plateau, with the neighboring coast region to the westward, nearly all the La Plata plains, and the region thence southward to Tierra del Fuego, which belongs also to this region.

"As contrasted with the Tropical Realm to the northward, it is characterized, in respect to mammals, by the absence of all *Quadrumana* and the paucity of Edentates and Marsupials, there being neither Sloths nor Anteaters, while only two or three species of Opossums barely extend over its borders; the absence of all genera of Leaf-nosed bats, and of not less than a dozen important genera of Rodents, the Coatis, the Kinkajou, the Tapirs, and many other genera characteristic of the American tropics.* As noted by Mr. Wallace, it is further characterized by the possession of the entire family of the *Chinchillidæ*, the genera *Auchenia*, *Habrocomus*, *Spalacopus*, *Actodon*, *Ctenomys*, *Dolichotis*, *Myopotamus*, *Chlamadophorus*, to which may be added the marine genera *Otaria*, *Arctocephalus*, *Morunga*, *Lobodon*, and *Stenorhynchus*, very few of which range beyond the northern border of this region. The Spectacled Bear is also confined to it, and here are also most largely developed the Murine genera *Calomys*, *Acodon*, and *Reithrodon*."

Mr. Allen might have derived additional cogent evidence for the independence of this realm from the fresh-water fishes, which, in fact, show more relationship to those of New Zealand and Tasmania than to the tropical American types. Indeed, this relationship is such that an English ichthyologist of some note, Dr. Günther, has proposed to unite the two regions under the name of Archinotian Realm.

*"Among the genera of the Brazilian region here unrepresented are, aside from the *Quadrumana*, *Cercoleptes*, *Nasua*, *Tapirus*, *Bradypus*, *Chœlopus*, *Myrmecophaga*, *Tamandua*, *Cyclothurus*, *Phyllostoma*, *Glossophaga*, *Arctibeus*, *Dysopes*, (and other genera of *Chiroptera*,) *Hydrochœrus*, *Cercomys*, *Dactylomys*, *Loncheres*, *Echimys*, *Cœlogenys*, *Dasyprocta*, *Chœtomys*, *Cercolabes*, *Lepus*, *Sciurus*, *Habrothrix*, *Oxymycterus*, *Holochilus*, etc., = 27+."

ther, has considered the several countries as constituents of a single "region," called the Antarctic region, whose subdivisions were designated as the Tasmanian, New Zealand, and Patagonian "subregions," and which were, in his opinion, "almost identical." On the whole I am now inclined to follow Mr. Allen in differentiating this realm from the South American, somewhat contrary to my former views, although I do so with some hesitation.

THE ANTARCTIC OR SOUTH CIRCUMPOLAR REALM.

Mr. Allen has enunciated the following views respecting an Antarctic Realm:

"The Antarctic Realm is geographically almost wholly oceanic, and its fauna hence consists almost exclusively of marine or pelagic species. It necessarily embraces not only the Antarctic Zone, but a large part of the cold south-temperate, since very few of its characteristic species are wholly restricted to the Antarctic waters. It will hence include not only the few small groups of Antarctic Islands, but also Tierra del Fuego and the Falkland Islands, and perhaps also the extreme southern shores of South America, while some of its characteristic forms also extend to New Zealand, and even Australia and the Cape of Good Hope. The only mammals that can be considered as strictly characteristic of this region are Pinnipeds and Cetaceans, of which several genera of each are almost wholly restricted to it. A "South Frigid," "Antarctic," or "South Circumpolar" "Zone," "Region," or "Realm," has been recognized by various writers for the marine invertebrates, and, by von Pelzeln for birds, with limitations much as here assigned. While the number of species peculiar to it is small, it is large relatively to the whole number represented, especially in the colder latitudes. There is, of course, a broad belt along its northern border of a transitional character, where Antarctic types overlap the range of groups characteristic of south-temperate latitudes."*

As it is admitted that no terrestrial or fresh-water animals have been found in the Antarctic regions, it is not obvious why such a realm should have been proposed in connection with the distri-

*Allen op. cit., p. 372.

bution of terrestrial vertebrates, and it will be premature to even consider it till such animals have been found.

Such are the "realms" or "regions" recognized by Messrs. Wallace and Allen.

But there still remain large extents of land and water which have not been recognized as independent realms by either Messrs. Wallace or Allen, but which have been referred to a heterogeneous Australian one, as a kind of refuge of the destitute. These we shall consider as a sequel to the determination of the "realms," which our inquiries and criticisms have naturally now led us to.

In fine, we see reason for admitting nine primary divisions of the earth's inland surface, characterized by major associations of animals. Beginning with home, and proceeding to the successively more differentiated realms, these are (1) the Anglogæan or North American; (2,) the Eurygæan or Eurasian; (3,) the Indogæan; (4,) the Afrogæan; (5,) the Dendrogæan or Tropical-American; (6,) the Amphigæan or Temperate South American; (7,) the Austrogæan or Australian; (8,) the Ornithogæan, or New Zealand; and (9,) the Nesogæan or Polynesian.

I.—THE ANGLOGÆAN OR ARCTAMERICAN REALM.*

I. The North American or Nearctic Realm embraces North America from its northern boundaries, where it approaches, on opposite sides, the Eurasiatic realm, southward into Northern Mexico, projecting into that country to a considerable distance along the extension of the Rocky Mountains, and ceasing somewhere near the southwestern boundary of the United States on the lowlands. It has representatives of 26 families and about 250 species of mammals, exclusive of the marine types; about 60 families and not far from 800 species of birds (Baird, Brewer, and Ridgway); 25 families, and about 250 species of reptiles; 14 families and about 100 species of amphibians; 17 families and about 600 species of

* Some synonyms of the realm names adopted are given at the commencement of each paragraph.

fresh-water fishes, and 1 family and 6 or 7 species of Marsipobranchiates. Of these, several are wholly or almost peculiar to the region. These are, of mammals, the Antilocapridæ, Zapodidæ, Geomyidæ, and Haploodontidæ; of birds, the Chamæidæ (of very doubtful value); of reptiles, the Lichanuridæ; of amphibians, (according to Cope,) the Scaphiopodidæ, Plethodontidæ, Amblystomidæ, Amphiumidæ, and Sirenidæ; and of fishes, the Centrarchidæ, Elassomidæ, Aphredoderidæ, Amblyopsidæ, Percopsidæ, Hyodontidæ, and Amiidæ. Of the others, those characteristic of the northern portions of the region are shared in common with Europe and Northern Asia, while such as are especially represented in the southern portions are held in common with South America. On the whole, however, the predominant type of the region—and only more decidedly so to the northward—is akin to that of the Eastern hemisphere, and the South American aspect given to the region is apparently due rather to the (geologically) recent intrusion of South American types than to its being the natal abode of such forms.

Of the other classes of animals, those most noteworthy are the gastropods and conchifers; the former is extremely rich in species of the family of Ceriphasiidæ, which includes Melanioids of peculiar genera; the latter is even to a still greater degree exuberant in species representing also numerous sections, or sub-genera, peculiar to the region. In fact, over 400 species of gastropods, most of which belong to the Ceriphasiidæ, and about 600 species of conchifers, the greater portion of which are members of the family of Unionidæ, have been attributed to the region, but these numbers are undoubtedly greatly exaggerated. It may be added, in conclusion, that several of the families and genera now peculiar to the realm were, in early geological epochs, represented elsewhere, the Lepidosteidæ, for instance, having formerly had members in Europe. Several of the peculiar genera are also of great antiquity, characteristic sections or genera of Viviparidæ, Melaniidæ, and

Unionidæ having existed as early as the Cretaceous and even the Jurassic period.

II.—THE EURYGÆAN OR EURASIATIC REALM.

The European or Palæarctic Realm is the largest of all, and embraces the entire northern portion of the Old World. Its southern limits nearly coincide with the tropic of Cancer in the lowlands, and its isotherm projected therefrom in the more rugged countries. In Africa it extends into the Desert of Sahara, and in Asia it is limited by the Himalaya Mountains and their spurs. It possesses members of 31 families of terrestrial mammals, 55 of birds (according to Wallace), 25 of reptiles, 9 of amphibians (according to Günther), and 16 of fresh-water fishes. None of these families, however, are continuous over the entire area and at the same time peculiar to it. It is true that several families are restricted within its limits, such as the Trogonophidæ and Ophiomoridæ among reptiles, and the Comephoridæ among fishes, but these are very limited in their distribution; the family Comephoridæ, *e. g.*, is represented by a single species, confined to a single lake (Baikal) of Siberia. The realm is characterized, therefore, rather by what it has not than by what it has among families, and is based mainly on the structural modifications of minor value (generic or specific) of its constituents.

III.—THE INDOGÆAN REALM.

The Indian or Oriental Realm is of less extent than either of the two preceding ones, but is nevertheless richer than either in the number of species. It extends from the Himalayan range on the north to the Indian Ocean on the south, and toward the S. E. is limited by the narrow but deep strait which intervenes between Celebes Island and its dependencies on the one hand, and Borneo on the other, and also between the island of Lombok on the one hand and Bali on the other; it thus includes the peninsulas of Hither and Farther India, and the Indo-Malayan Archi-

pelago and Philippine Islands. In it are found 33 families of terrestrial mammals, 71 families of birds (according to Wallace), 25 families of reptiles, 9 of amphibians, and 15 of fresh-water fishes. Of these, 12 are peculiar, viz: among mammals, the Tarsiidæ, Galeopitnecidæ, and Tupaiidæ; among birds, the Liotrichidæ, Phyllornithidæ, and Eurylæmidæ; among reptiles, the Xenopeltidæ, Uropeltidæ, and Acrochordidæ; and among fishes, the Luciocephalidæ, Ophiocephalidæ, and Mastacembelidæ. As in the case of other regions, there is considerable diversity of opinion as to its relations to others, and as to its several subdivisions.

IV.—THE AFROGÆAN REALM.

The African or Ethiopian Realm, as the name indicates, includes the greater part of the African continent, but not all, it being limited on the N. by the Desert of Sahara, although on all other sides bounded by the ocean; but it also comprises the island of Madagascar and the Mascarenes, as well as, according to some recent authors, the peninsula of Arabia. It is distinguished especially in that it possesses the highest types, after man, of the order Primates, and which are in all respects the most anthropoid. This region is also further distinguished by the restriction to it of as many as ten isolated families of mammals, viz: Daubentoniidæ, Cryptoproctidæ, Protelidæ, Camelopardidæ, Hippopotamidæ, Lophiomyidæ, Centetidæ, Potamogalidæ, Chrysochloridæ, and Orycteropidæ. Among birds, there are six so-called families peculiar to it—Paictidæ, Musophagidæ, Coliidæ, Leptosomidæ, Irrisoridæ, and Serpentariidæ. The most marked, however, are the fishes, of which there are fourteen families; of these, five are peculiar, viz: Pantodontidæ, Kneriidæ, Mormyridæ, Gymnarchidæ, and Polypteridæ, and three are shared with South America alone—Cichlidæ, Characinidæ, and Lepidosirenidæ. This realm, like all the others, has been subdivided by Wallace into four regions, or, as he designates them, "subregions," viz: (*a*) the East African, (*b*) the West African, (*c*) the South African, and (*d*) the Malagassy.

V.—THE DENDROGÆAN REALM.

The South American or Neotropical Realm extends from the N., near the northern boundaries of Mexico in the lowlands, and lower down in the highlands, to the temperate regions of South America, and its dependencies, for with it are also generally associated the West Indian Islands. It has 30 families of mammals, 73 of birds, 35 of reptiles, 16 of amphibians, and 17 of fresh-water fishes. An unusual proportion of these are peculiar to the region, or nearly so. Among the mammals are the Cebidæ, Mididæ, Desmodidæ, Dinomyidæ, Caviidæ, Hydrochœridæ, Bradypodidæ, Dasypodidæ, Tatusiidæ, and Myrmecophagidæ. Several of the families which are shared in common with North America are also almost as characteristic, the North American species being rather intruders therein from the region under question than true autochthones. Such are the Procyonidæ, Bassaridiidæ, Saccomyidæ, Cercolabidæ, Phyllostomidæ, and Didelphididæ. Other families are peculiar in their distribution: for example, of the Tapiridæ, two well defined genera and several species are found in South America, and the only other representative is distant as far as the Indo-Malayan Archipelago. These are anomalies, however, that become readily explicable when it is recalled that, in previous geological epochs, both of the said families were extensively distributed over the northern hemisphere, and consequently the widely-separated living forms are evidently simply surviving representatives of formerly widespread types. Of birds, according to the views of Wallace and many ornithologists, 22 families are restricted to the region, and 7 others are common and peculiar to it and the North American region. The peculiar families of birds, according to Wallace, are the Cærebidæ, or sugar-birds; Phytotomidæ, or plant-cutters; Pipridæ, or manakins; Cotingidæ, or chatterers; Formicariidæ, or ant-thrushes; Dendrocolaptidæ, or tree-creepers; Pteroptochidæ; Rhamphastidæ, or toucans; Bucconidæ, or puff-birds; Galbulidæ, or jacamars; Todidæ, or todies; Momotidæ, or motmots; Steatornithidæ, the guacharo or oil-bird; Cracidæ, or curassows; Tinamidæ, or tina-

mous; Opisthocomidæ, the hoazin; Thinocoridæ; Cariamidæ: Aramidæ; Psophiidæ, or trumpeters; Eurypygidæ, or sun-bitterns; and Palamedeidæ, or horned screamers. The Trochilidæ, or humming-birds, are especially noteworthy on account of their great numbers. Six families of reptiles have also been claimed as peculiar to the realm, and among the lizards the family of Iguanidæ is remarkably developed. Four families of amphibians and four of fishes are also considered as restricted to the realm. The relation between the fishes of South America and Africa is another feature of special significance: there are three families shared between the two, and found nowhere else, and genera of the respective families are not distantly related, although none are actually common to the two realms.

VI.—THE AMPHIGÆAN REALM.

The Temperate South American Realm may retain provisionally the limits assigned to it by Mr. Allen, and as these have already been specified when considering Mr. Allen's views, it is unnecessary to repeat them here. Within its limits occur representatives of several peculiar groups; there are 18 families of terrestrial mammals, two of which (the Chinchillidæ and Chlamyphoridæ) are almost confined to it, and two (Ursidæ and Camelidæ) are shared with the northern realms without occurring in the contiguous realm; 42 so-called families of birds, three of which (the Chionididæ, Thinocoridæ, and Rheidæ) scarcely or not at all encroach northwards; 15 families of reptiles; 11 families of amphibians; 5 families of fishes, two of which are shared with New Zealand and Tasmania, and scarcely extend into Tropical America; and one family of Myzonts, also shared with New Zealand and Tasmania.

VII.—THE AUSTROGÆAN REALM.

The Australian Realm is of all the most distinctly defined by its fauna. As it will be here limited, it comprises Australia and the immediately outlying islands, and the Austro-Malayan Archi-

pelago. It is limited northward by Wallace's line or strait, which separates Lombok from Bali and Celebes from Borneo, including Papua or New Guinea and the Solomon Islands to the eastward, and southward embraces Tasmania or Van Diemen's Land. It is especially distinguished by its numerous marsupial mammals, and by the almost complete restriction of the class to representatives of that order, the rodents and the bats; the Monotremes are also characteristic of the realm, and entirely confined to it. The class of birds likewise has a number of very characteristic types: chief of these are Megapodidæ and Casuaridæ, but there are several others—*e. g.*, the Paradiseidæ, Meliphagidæ, Menuridæ, and Atrichidæ—that are almost equally peculiar. The reptiles and amphibians are perhaps less noteworthy, although they present some interesting features of detail. The fresh-water fishes are, however, especially remarkable; while many of what may be called marine families are represented by fluviatile species, there are several that are peculiar to it or only found elsewhere in South America. Among the former is the family Ceratodontidæ, which in former geological epochs was extensively represented in other parts of the world, but is now peculiar to Australia. Among the latter are the families Percophididæ, Haplochitonidæ, Galaxiidæ, Osteoglossidæ, and Symbranchidæ. The articulates and mollusks also afford a large number of characteristic forms. The primary subdivisions of the realm are two.

VIII.—THE ORNITHOGÆAN REALM.

The New Zealand sub-region of Mr. Wallace cannot be satisfactorily referred to the Australian or any other realm, and, although its peculiar characters are not very salient, it should apparently be isolated as a peculiar realm. The name Ornithogæa, proposed nearly ten years ago, may be retained for it. In prehistoric times, it was the abode of a number of gigantic struthiiform birds, which have been referred to one or two peculiar families—the Dinornithidæ and Palapterygidæ—and a related family—the Apterygidæ—is still

represented by four species. There are also many other birds representing genera peculiar to New Zealand. Here also live the only survivors (*Sphenodon* or *Hatteria*) of an order of reptiles (Rhynchocephalia) which, in ancient times, had a wide distribution. The fresh-water fishes are few, but noteworthy. One genus (*Galaxias*) is common to the temperate portions of Australia and South America, another (*Prototroctes*) to New Zealand and South Australia, a third (*Neochanna*) of the family of Galaxiidæ is peculiar, and also peculiar is a genus (*Retropinna*) distantly related apparently to the Argentines (smelts, etc.) of the northern realms. The Gastropod mollusks, and other invertebrates exhibit a peculiar association of types, which, at the same time, re-enforces the distinctness of the realm and gives rise to special problems of zoogeography.

IX.—THE NÉSOGÆAN REALM.

The restricted Polynesian realm is distinguished by negative rather than positive characters, and is to some extent a "refuge of the destitute." It includes all the islands of the tropical portions of the Pacific Ocean combined under the general name Polynesia. It is distinguished from all others by the total—or almost total—absence of indigenous types of mammals. The other common characters are very few; the avian types, on the whole, recall mostly the Australian forms. There are, according to Wallace, "not more than about 50 genera and about 150 species of land-birds." It is possible that these islands are the remains of one or more continental areas, and that at least most of them have been submerged and lost their mammals, and on emergence, or rather upheaval, have been peopled from other territories. The analysis of this group would detain us too long, and this realm may, for the present, be considered as a provisional one, to be hereafter studied and properly limited.

All the primary zoogeographical divisions recognized by Messrs. Wallace and Allen have now been considered, but the relations of the several realms to one another may be glanced at with profit. As

will be remembered, there are fundamental differences involved in this respect between the views of Messrs. Wallace and Allen. Mr. Wallace's sequence of his "regions" implies a reminiscence of an ancient idea, which was expressed in the translation of the terms "Old World" and "New World" into respectively "Palæogæa" and "Neogæa" The realms of Mr. Allen traverse such primary groups, and are rather subordinated to climatic considerations. Still other groupings have been proposed, as, for example, by Professor Huxley, who has segregated the Eurasiatic, Indian, and African realms into an "Arctæoga," and the South American, or Austro-Columbian, Australasian, and New Zealand ones into a "Notogæa." And the present author has proposed to contrast the North American, Eurasiatic, and Indian realms under the denomination *Cenogæa*, with an *Eogæa*, comprising the African, South American, Australian, and New Zealand realms. Let us look at some of the facts which may determine our opinion in the case.

On the one hand, those forms of animal life which are capable of easy extension over extensive bodies of land or water, such as the birds, which represent the highest types, physiologically speaking, of life, are distributed in a manner to a large extent co-ordinate with the present arrangement of land and water. The birds seem to have especially become modified and adapted to the present topographical features of our earth at a (geologically speaking) recent epoch. On the other hand, those animals of a more lethargic character, or which are prevented by physical environments from extending their range, are grouped entirely otherwise. This is especially the case with the fresh-water animals of various kinds, and notably with the fresh-water fishes.

If the inhabitants of the fresh waters of the globe are taken into consideration, the several realms we have defined may be combined in quite a curious manner, which entirely contradicts the relations which the present combinations of land and water would suggest. It will then be seen that the inhabitants of the northern portions of the several continents of North America, Europe, and Asia belong,

in a great degree, to the same types; and although the realms thus associated are characterized by a number of forms peculiar severally to each of them, they form a natural whole in contradistinction to the others. Very closely connected with this division is the East Indian, and this forms with them an integral portion of a great super-realm or hemisphere.

In striking contrast with the association of forms characteristic of the several divisions alluded to are the fresh-water types of Australia. Most closely related to Australia in this respect is South America, and in the fresh waters of that continent are to be found several types which are common to the two continents. The only remaining continent—Africa—although presenting some forms that are common to it and India, on the whole furnishes us with an association of fresh-water forms which recalls the South American realm more than it does any other. Several families of fishes and a number of types of other animals are common to the two and are found nowhere else.

Combining these facts into a systematic whole, it has been proposed to segregate the several realms in the manner hinted at, and to combine under the name *Eogæa* (1) the Australian, (2) South American, and (3) African realms; and under the name *Cenogæa* (4) the North American, (5) the European, and (6) the East Indian realms. *Eogæa* gives to us a number of forms which remind us of the ancient inhabitants of the northern hemisphere, and hence the name, while *Cenogæa* has lost most of the forms that were characteristic of the past, and presents the newest aspect of the earth-faunas in contradistinction with the other.

An explanation of these relations may be found in one or other of two hypotheses. (1) The like forms may have originated where they are now found, and have been ever confined within proximately their present limits; or (2) they may be the survivors of anciently widely-distributed races. Neither hypothesis of itself is a sufficient explanation of all the associations in question, but each is applicable to different cases

At this point, I will ask your attention for some problems whose pertinency to our discussion will be evident, anda n answer to which will determine our action in questions yet to be considered.

THE EFFECT OF TEMPERATURE ON DISTRIBUTION.

Our experimental knowledge of the influence of temperature on animal life in isolated cases prepares us to find it a largely controlling factor in the geographical distribution of the various minor types, and the thermo-physiology of many super-generic types is in strict consonance with their morphology. Many of the forms which have been noticed as characteristic of specific realms or common to certain zones are limited in their range by thermometric conditions. As a rule, temperature exerts a paramount influence on the distribution of animal life. Nevertheless, the familiar adage that there is no rule without an exception holds good for all the laws of zoogeography. For instance, the tiger, which is associated, in the minds of most persons, with the jungles of torrid India, flourishes likewise in the frigid Amurland; the humming birds, so characteristic of tropical America, are represented by wanderers in the icy regions of both the north and south, and the cyprinoid fishes live and multiply, with not greatly unequal facility, in the waters of the torrid and frigid zones. Nevertheless, the rule in general is that temperature is a most important factor in distribution, and probably to its influence, in connection with the former distribution of animal types and the bounds of older continents, are due some of the differences which are now so salient, as, for instance, between the North American and Eurasiatic realms.

In former times, families now confined to America were also represented in Europe; such are the Snapping turtles or Chelydridæ and the Lepidosteidæ. Perhaps their present absence from the European fauna is due to their former limitation southward, and the cold of the Quaternary period, which extended over the whole of their European domain and exterminated the species, while in America, although the individuals over a large extent of territory

succumbed, the types continued to survive in the south, and the deserted lands were repeopled when a gentler climate again prevailed.

It is well known that the equatorial inhabitants of the old and new worlds are quite dissimilar from one another, and it may be thought that such dissimilarity is antagonistic to the law that temperature is a primary factor in distribution. The facts in the case, however, seem at once to justify the law and to necessitate the invocation of another. Undoubtedly there are no hindrances offered by the climates of the several equatorial regions to the life of any of the tropical types of life in all of the tropical regions. Their limitation, therefore, must be looked for in other causes; the conditions imposed by climate on the north and south, where the continents converge, have forbidden their extension, and the distinctiveness of the types characteristic of the several regions is a result of the laws of evolution acting during the long ages of dissolution of the respective regions.

WHAT TYPE IS MOST FITTED TO EXPRESS FAUNAS?

As will be remembered, Mr. Wallace has especially insisted on the super-eminent availability of the mammals for the determination of faunal regions, and in this respect is cordially endorsed by Mr. Allen. I fail, however, to appreciate the entire force or pertinence of their reasons, although to some extent pertinent. The mammals are certainly the best and the only factors to determine the mammalian faunas, but for general faunas all animals are to be considered. The survey of the chronological and geographical history of the various classes of the animal kingdom reveals marked discrepancies between the several types in both of these cases, and we are led to postulate several propositions as tentative hypotheses for proof or disproof. All other things being equal, (1) the longer a type has been in existence, the more widely should it have been disseminated; (2) the later a type has supervened, the more restricted should it be, and the closer its accommodation to existing

conditions; (3) the stricter the environments of a type are, the less are its means of dispersal; and (4) the greater the facilities of a type are for extension of its range, the wider should be its range.

Now, these propositions are such that they might at first appear to be shallow truisms, but the emphatic proviso that *all other things should be equal* is especially necessary to keep us from error in applying the several propositions to the actual faunas. A brief glance at the past history of some classes will render the necessity evident. For example, on the one hand, even in the Palæozoic period, among others, representatives of the classes of Lamellibranchiates, Gastropods, Arachnids, and Insects lived, which are inseparable from families still in existence, while, on the other hand, extremely few, if any, families of mammals or birds have a history which extends back as such into the Eocene Tertiary; between the two categories expressed by such types the fishes form an intervening term. Presumably, we should, therefore, be justified in expecting a wide distribution of the first series of types, and, inversely, from their geographical distribution, we should expect a long life history for them. Our provisions in both cases would be justified by the facts. And further, a study of the distribution of those types shows that their ranges, in higher groups, are very imperfectly co-ordinate with the present distribution of land.

The fresh-water fishes had become more differentiated than the invertebrate types, in Mesozoic and Tertiary times, and are, therefore, better exponents of the later past relations of continental areas than they are. Their presence, as well as their absence, are very significant, and the bearings of such distribution have been partly indicated in connection with the proposition to recognize the Eogæan and Cenogæan worlds. Their study will avail much hereafter in the reconstruction of the continents of the older epochs, and the solution of the derivations of their faunas. Suffice it now to express the opinion that the fishes are among the best indicators of the ancient continental areas, and that the relations of the several southern continents as to their ichthyic faunas can be best under-

stood by the assumption that at some remote epoch or epochs, (but not probably at any one time,) there was a distribution of land which eventually permitted an emigration and immigration of types from one and into another. The absence or slight intrusion of such forms into the northern continent suggests the doubt as to a perfect continuity of the land or fresh-water systems. There are, however, doubtless other explanations available.

Thus far our attention has been confined to the inland—terrestrial and aquatic—animals, and these alone have been relegated to definite realms or regions by Messrs. Wallace and Allen. The marine faunas of the globe have been practically ignored by both of these students, their attention having been chiefly devoted to the inland regions. The marine realms, however, are entirely independent of the fluvio-terrestrial, and their characteristic associations of animals are determined by other factors. The groupings which I shall now adopt were first outlined by me in 1875,* but certain of the fundamental facts were long ago appreciated.

The importance of attention to the temperature of the sea, and especially to that during the coldest month of the year in the two hemispheres, in relation to zoogeography, was, perhaps, most fully appreciated at first by the illustrious and versatile Dana, who, just about thirty years ago, published, for the time, an excellent "Isocrymal Chart to Illustrate the Geographical Distribution of Marine Animals" and an accompanying memoir,† in which zoogeographical principles were discussed with eminent learning and wisdom. The chart is still one of the most useful in existence for the student of zoogeography, but later ones answering the purpose, and embodying more recent observations, have been published by

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* THEODORE GILL. On the Geographical Distribution of Fishes. <Ann. and Mag. Nat. Hist., (4,) vol. 15, p. 251–255; April, 1875. See also Johnson's New Universal Cyclopædia, vol. 2 and 4, and The Nation, vol. 24, pp. 27–29, 42, 43; July 12 and 19, 1877.

† JAMES D. DANA On an Isothermal Oceanic Chart, illustrating the geographical distribution of marine animals. <Am. Journ. Sc. and Arts, (2,) vol. 16, pp. 153–167, 314–327; Sept. and Nov., 1853.

the British admiralty, and in the Encyclopædia Britannica*. Nevertheless, charts based upon the latest observations of the numerous explorations that have been made within the past decade and especially adapted for the zoologist are great desiderata, and it is hoped that our own Coast Survey and Hydrographic Office, or the United States Fish Commission, may supply the want.

Prof. Dana† recognized nine "regions" or categories of temperature, segregated under three "zones," and all these, except the equatorial, were duplicated in the respective hemispheres, thus:

I.—TORRID OR CORAL-REEF ZONE.

Regions.	Isocrymal limits.
1. Supertorrid, [Eq.]	80° F. to 80° F.
2. Torrid, [Eq.]	80° to 74°
3. Subtorrid, [N., S.]	74° to 68°

II.—TEMPERATE ZONE.

1. Warm Temperate, [N., S.]	68° to 62°
2. Temperate, [N., S.]	62° to 56°
3. Subtemperate, [N., S.]	56° to 50°
4. Cold Temperate, [N., S.]	50° to 44°
5. Subfrigid, [N., S.]	44° to 35°

III.—FRIGID ZONE.

1. Frigid, [N., S.]	35° to 26°

It is suggested that an additional "region, called the Polar, may be added, if it should be found that the distribution of species living in the frigid zone requires it, There are organisms that occur in the ice and snow itself of the Polar regions; but these should be

* The Wind and Current Charts for the Pacific, Atlantic, and Indian Oceans, giving the isothermals of February for the northern hemisphere, and of August for the southern, published in 1872, will be found the most useful. These have been essentially reproduced in the article "Meteorology" of the Encyclopædia Britannica, vol. 16, p. 133, 1883.

† DANA, op. cit., p. 157.

classed with the animals of the continents, and the continental isotherms or isocrymes, rather than the oceanic, are required for elucidating their distribution."

The highest segregations of the marine faunas, as admitted by Prof. Dana, are three divisions or "kingdoms," viz: "1, the *American or Occidental*, including east and west America; 2, the *Afrîco-European*, including the coasts of Europe and western Africa; and, 3, the *Oriental*, including the coasts of eastern Africa, East Indies, eastern and southern Asia, and the Pacific. Besides these, there are the *Arctic* or *Antarctic* kingdoms, including the coasts of the frigid zones, and, in some places, as Fuegia, those of the extreme temperate zone."

We have thus, from similar data, generalizations tending in opposite directions, (1) that which was postulated as to the distribution of marine life in zones, and (2) the one just recalled, which correlates the distribution rather with the lay of the land.

Much may be said in favor of each proposition, and it is certain, as I long ago contended,* that "the relations between the successive faunas, in a latitudinal direction of the shores of the several continents, are traversed by relations existing, in a longitudinal direction."

But I am inclined to think that an unconscious bias from the long-prevalent ideas respecting the pertinence of marine forms to the inland faunas, may have influenced Prof. Dana more than the facts so well presented in his discussion.

I repeat further what I then also urged. There appears to be a total want of correlation between the inland and marine faunas, and a positive incongruity, and even contrast, between the two in their relations to others. This antagonism has been appreciated by very few. In most works it is quietly assumed or insisted upon that the sea and inland animals of a given region are integral constituents of a homogeneous fauna, and by implication, at least, that

* The Nation, vol. 24, p. 43, July 19, 1877.

such fauna has in its several parts one and the same relation to others. Such is very far from being the case.

The several tropical faunas are, for example, much more closely related to one another than they are to the faunas along the same reach of shore toward the arctic or antarctic regions. This relationship is evinced more or less in every class and branch of animals, *e. g.*, the mammals, the fishes, the mollusks, the crustaceans, the worms, the echinoderms, and the cœlenterates. Consequently, the marine faunas cannot be at all correlated with the primary realms or regions of the globe. To such an extent does temperature determine the distribution of life in the seas that even bathymetrical conditions may be subordinated, and types of the shallow arctic and antarctic seas represented in the cold deep sea under the equator. Some forms almost identical reappear at the opposite poles. The inference is irresistible that such types have migrated from common ground, and may have originally developed either in the deep sea and thence dispersed in opposite directions, or at one of the extremes, and wandered thence over the bottom to their final resting places. However this may be, a primary combination of the marine faunas is most natural under the categories of Tropicalian, Arctalian, and Notalian, while the temperate ones are rather the complexes of the bounding regions.

The views thus enunciated I propose now to reinforce, but it may be expedient to give specific names to the northern and southern temperate regions. The primary marine regions or realms would, therefore, be (1) the Arctalian, (2) the Pararctalian, (3) the Tropicalian, (4) the Notalian, and (5) the Antarctalian.

I.—THE ARCTALIAN REALM.

Arctalia, or the Arctic realm, for the sake of definition, might be confined to the seas of the northern hemisphere, limited southward by the course of floating ice, which descends on the eastern coast of North America as far as the Gulf of St. Lawrence. But so few types are peculiar to that area, and so many of the character-

istic forms, such as families of fishes, (Cottidæ, Anarrhichadidæ, Stichæidæ, Cyclopteridæ, Liparididæ, Agonidæ, Gadidæ,) and of mollusks, (Buccinidæ, Lacunidæ, etc.,) as well as other invertebrates, extend further southward, that the isocryme of 44° seems to be a more natural approximate limit. It has the disadvantage (in which it is not alone) of being an empirical boundary without any known relationship to cause, and must be regarded simply as a provisional limit. The isocryme nearly coincides with Cape Cod on the eastern coast, and the Straits of Fuca on the western. Doubtless its limits will require considerable modification hereafter, and it may be doubted whether the isocryme corresponds with the natural limits of the realm elsewhere. All these questions, however, must be left for future investigation.

II.—THE PARARCTALIAN REALM.

Pararctalia, or the north temperate realm, may include the various coast lines between the isocrymes of 44° and 68°, the last being the northern limit of the reef-growing corals. There are few, and perhaps no families absolutely peculiar to it, and it is chiefly distinguished by generic and specific modifications of the Arctalian and Tropicalian realms, commingling in common waters. On our eastern coast, it is characterized especially by such fish types as the genera Alosa, Cyprinodon, Fundulus, Lucania, Scombresox, Siphostoma, Menidia, Xiphias, Pomatomus, Stromateus, Roccus, Centropristis, Orthopristis, Stenotomus, Archosargus, Pogonias, Liostomus, Menticirrus, Cynoscion, Tautoga, Ctenolabrus, Chætodipterus, Astroscopus, Prionotus, Batrachus, Chasmodes, Hypleurochilus, Ophidium, Urophycis, Paralichthys, Pseudopleuronectes, and Malthe. Not one of these belongs to a family peculiar to either the special region in question or the realm of which it forms a part. Most of these genera are represented by congeneric species, or closely related generic types in other parts of the realm.

III.—THE TROPICALIAN REALM.

Tropicalia, or the Tropical realm, may be accepted with the

limits assigned by Dana to the "Torrid Zone or Coral-reef Seas," including all between the isocrymes of 68° F., the reasons urged by Dana being quite satisfactory. "In adopting these lines in preference to those of other degrees of temperature we have been guided by the great fact that the isocryme of 68° is the boundary line of the Coral-reef Seas."* The existence of these fixed animals, and the reefs which they elaborate, are among the best of living thermometers, and the numerous forms that are associated with, or dependent on, them for flourishing life concur to make them the most reliable indicators and coincidents of temperature. The characteristic types are very numerous, and among the families nearly or quite confined to it, but common to all its subdivisions, are, of fishes, the Murænidæ, the Ophichthyidæ, the Albulidæ, the Synodontidæ, the Scombresocidæ, the Sphyrænidæ, the Priacanthidæ, the Serranidæ, the Chilodipteridæ, the Mullidæ, the Pseudochromidæ the Carangidæ, the Chætodontidæ, the Acanthuridæ, the Polynemidæ, the Gerridæ, the Pomacentridæ, the Labridæ, (except Labrinæ,) the Scaridæ, the typical Scorpænidæ (Vert. 10 + 14,) the Eleotrine Gobiidæ, the Antennariidæ, the Triacanthidæ, the Balistidæ, the Ostraciontidæ, and the Diodontidæ. The few representatives of these families or sections which occur in temperate seas are chiefly summer wanderers, although a few have established themselves beyond their legitimate realm. With these are associated numerous invertebrate types, many of which the most of you will be able to recall. It includes a portion of the Floridian coast.

IV.—THE NOTALIAN REALM.

Notalia, or the south temperate realm, may provisionally be said to extend from the southern isocryme of 68° to that of 44°. Like its northern analogue, it is distinguished by the commingling of modified derivatives from the cold and equatorial realms rather than by peculiar family types. Among the most noteworthy and char-

* DANA, op. cit., p. 155.

acteristic of its fish types are various forms of Nototheniidæ, Percophididæ, Chilodactylines, Haplodactylines, and Agriopodidæ. The Selachian genus *Callorhynchus* is also limited to the realm. It thus differs much from the Pararctalian, but, nevertheless, a number of genera, as was long ago shown, reappear in it, although they are absent in the superficial waters of the tropics.

V.—THE ANTARCTALIAN REALM.

Antarctalia, or the Antarctic realm, corresponds to Arctalia, and may cover the antipodal ocean up the isocryme of 44°, (the only continental area thus embraced being Patagonia) northwards on the east to somewhere near or about the mouth of the Rio Negro, and on the Pacific coast to about the latitude of 50° S. As a rule, the fauna is very different from the Arctalian, and to some extent the characteristic arctic types of fishes are represented by analogous types of entirely different families, the role of the Gadidæ being assumed by Nototheniidæ, and that of the Cottidæ by Harpagiferidæ and Chænichthyidæ. Nevertheless, the Gadidæ have an inconspicuous representative and the genera *Myxine*, *Squalus* (*Acanthias*), and *Merlucius* have typical species scarcely or not at all differentiated from their arctic allies.

Lest an exaggerated idea should still be entertained as to the demarcations of the several regions, I think it necessary to repeat specially that not only are the exact limits of such not fixed or fixable, and variable even according to the season, but they may actually coexist in the same vertical, and one may be superposed over the other, or the reverse. An example among many is to be found off the New England coast. It has been repeatedly adverted to by Prof. Verrill,* and is familiar to many of you present. Indeed, as I shall presently show, there are at varying depths horizontal faunal assemblages of animals as well as those superficial or shallow-water ones more familiar to most persons.

*A. E. Verrill, in the Report of the U. S. Commission of Fish and Fisheries, part I, pp. 484, 485, 1873, etc.

THE BASSALIAN REALM.

At indefinite distances below the surface, even in the tropics, we find strange forms of animal life which differ, not only specifically and generically from those of the superincumbent water, as well as from those of the cold extremes of the globe, but sometimes represent even peculiar families. Those forms which live at moderate depths, existing as they do, in cold water, are related to, or even belong to, the polar faunas, but as we go still deeper we find still other assemblages of animals. Those of the lowest horizons are often wonderfully modified, and the deep-sea explorations of recent years have brought to light many remarkable forms. Among fishes, for example, are certain types that have long been known from stragglers from the lesser deep, such as the Saccopharyngidæ, Nemichthyidæ, Notacanthidæ, Chauliodontidæ, Stomiatidæ, Paralepididæ, Alepisauridídæ, Alepocephalidæ, Regalecidæ, Trachypteridæ, Berycidæ,* Brotulidæ, Macruridæ, and Ceratiidæ, several of which have been greatly increased of late. Other types have been discovered comparatively recently, as the Eurypharyngidæ, Bathylagidæ, Bathythrissidæ, Halosauridæ, and Chiasmodontidæ. It is obvious, then, that we have, in such an aggregate, a combination of forms very different from any of the superficial faunas we have heretofore considered. We will be justified, therefore, in recognizing for them another realm, which we may call Bassalia† or the Bassalian realm. But caution is timely that it is rather a heterogeneous one, and may hereafter require restriction. The data now available are insufficient, however, for differentiating what are, doubtless, the several constituents or regions of this realm.

One of the characteristic features of the Bassalian animals appears to be their wide dispersion and range. The same species may recur at opposite points of the globe, and they appear to be restricted less by latitude and longitude than by bathymetrical influ-

*The Holocentridæ represent another type.

† *Βάσσων*, Doric Greek equivalent of *Βαθυς*, the deep, and *ἀλία*, an assemblage.

ences. Most of the species hitherto found, it is true, have been obtained only about one locality, but it must be remembered that comparatively few individuals have been found, and their acquisition is often due to happy accidents rather than special collecting. On general principles, we are prepared to expect such a wide range. In the abyssal depths, which these animals inhabit, the conditions are perfectly uniform, and have so remained practically for geological ages, and it is, therefore, quite natural that among such forms we should find representatives of types that long ago disappeared from other parts of the globe.

It will be observed that I have given for the several realms names with a uniform termination, employing the suffix *gæa* for the inland and *alia* for the marine ones; the former has been frequently used before; the latter is a transliteration of the Ionic Greek *ἁλίη*, (an assembly or gathering,) and is selected on account of the flavor or reminiscence it involves of the salt of the sea, or the sea itself.* I think myself that such a system of nomenclature will be convenient on accout of dissociating our ideas of geographical realms from precise geographical regions, and also emphasizing the contrast between the inland and marine faunas. Whether they shall be adopted or not, however, must be left for individual preference.

Permit me now to indicate certain desiderata, and how our knowledge of zoogeography may be extended. Full catalogues of all the animals found at specific points will be especially useful, but to insure their usefulness, data should be given respecting their seasonal or permanent sojourn, their abundance, the depths at which they live, and the temperature of the water at various seasons. Great caution should be exercised, too, in admitting forms which may be simply adventitious wanderers, for the *cacœthes acquisitionis* may impose serious obstacles to the proper appreciation of zoogeographical principles. Of course, I do not mean that the

* Compare *συναλίζω* (from *σύν* and *ἁλίζω*) to assemble or, radically, come together around the salt.

casual visitants to a country should be ignored, but I do think that it is a wrong to science to enumerate, for examples, an European vagrant to America, never found but once, and not likely to recur again for an indefinite time, if ever, or an American bird that has been once found in Britain, in a line with the well-known members of the respective faunas. Their place would be most natural in an appendix or foot note, and they should at least be without the serial numeration, if such is given, of the catalogue of permanent and seasonal members of the fauna. Let me also protest, as I have done several times before, against the incorporation of Bassalian types with the species of littoral faunas nearest to them geographically. With catalogues and data, such as I have indicated, at hand, we could soon determine, as closely as practicable, the limits of most of our faunas, and the general attention now paid to natural history holds out the hope that the coming time may not long be deferred.

In conclusion, I submit a few deductions that naturally result from our observations.

A distinction is to be made between the territory occupied by an association of animals and the occupants thereof, and the limits of faunas cannot be exactly correlated with territory, except in rare cases.

The significance of animal types as indicators of zoogeographical regions is, other things being equal, in ratio to their recent development.

The fresh-water types are the best indicators of the early relations of the respective regions.

The flying, and especially migratory, types are the most accordant with the actual relations of land areas.

Temperature is a prime factor, and land a secondary, in the distribution of marine animals.

The lay of the land is a primary, and temperature a secondary, factor in the distribution of inland animals.

CERTAIN PHASES IN THE GEOLOGICAL HISTORY OF THE NORTH AMERICAN CONTINENT, BIOLOGICALLY CONSIDERED.*

By Charles A. White.

It is quite certain that there has never been a time in the history of mankind when the thoughts of men were so eagerly turned to biological subjects as they are to-day; nor has there ever before been a time when an intelligent knowledge of them was so broadly diffused among cultivated persons. An earnest desire is everywhere manifested by such persons to obtain substantial knowledge concerning the animal and vegetable life of the earth, and of the broad significance of that life, which is revealed by a comparative study of its myriad forms. The investigator immediately finds that this subject, although it is so comprehensive and so complex, is only a fragment of a great history of life, which extends back through unnumbered ages. He finds himself at once confronted by questions concerning successive multitudes of former denizens of the earth, the physical conditions which prevailed when they existed, the probable lines of descent by which they came into being, and by which their successors have come down to the present time; and the manner in which those lines have probably originated and been preserved from destruction through successive geological periods.

This prevalent spirit of inquiry among men has been the cause of a vast amount of patient and exhaustive research, and it has also resulted in a large accumulation of knowledge. But it cannot be denied that every investigating naturalist, although he may fully accept the doctrine of evolution, finds the subject of the origin and derivation of the various groups of animals that now inhabit the earth, and those which have inhabited it during past geological time, to be beset with many difficulties and uncertainties.

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*Presidential Address delivered at the Fourth Anniversary Meeting of the Society, January 25, 1884, in the Lecture Room of the U. S. National Museum.

As a rule, too, he finds that the questions which arise in connection with the probable manner in which the various groups of animals have originated and become distributed over the earth are too complex to allow of their reduction to even approximately simple propositions. Still, the accumulated results of the various and extensive investigations which naturalists have made of late years have placed the general subject of the evolution of organic forms in such a condition as a working hypothesis, that some of its various divisions may be treated with considerable detail, even with reference to extinct faunas. Furthermore, in a great number of cases, the facts which have been observed are of such a character as to warrant opinions of so important a nature that they may be legitimately used as a basis for philosophical discussions. It is mainly upon such facts and opinions as these that the following remarks are based; and while the conclusions and opinions which are here expressed are believed to be fully warranted by known facts, it is only too evident that much, which it is very desirable to know in this connection, still remains beyond our reach.

That I may more clearly present my subject, I submit the following statement of certain views which I hold in relation to it; and, for the purpose of greater conciseness of statement in the remarks which are to follow, I shall refer to those views somewhat as if they were supported by established and acknowledged facts.

The general subject of the probable origin of the different forms of animal life, and their perpetuation through geological time being so broad, I must confine myself to such small portions of it as my studies have led me to understand as having an important bearing upon the geological history of the North American continent. I must, furthermore, confine myself to such portions of the subject as relate to terrestrial life only, leaving largely out of consideration the subject of marine life.

Since the points I wish to present are somewhat disconnected by our present imperfect knowledge, I must trust to making their relevancy more apparent when I come to make the proposed application

of them. A discussion of formerly existing vegetable forms would also be of great interest, but I must omit all except incidental reference to that subject also.

In all investigations into the history of ancient life upon the earth, regard must be had to the functions that animals perform, and to the conditions under which those functions are executed. The requisite conditions for the performance of the physiological functions in the simplest animal forms, the Protozoa, for example, render it practically certain that the primary origin of animal life occurred in water; and it doubtless occurred in the sea. The first animal life having necessarily been of aqueous origin, we must assume that the first air-breathing animals were developed from those of aqueous respiration.

Fresh-water mollusks and fishes, especially the former, have, I believe, primarily become such by a change from their originally marine habitat, mainly by compulsion; that is, their progenitors lived in the sea and became land-locked by the unequal elevation of the sea bottom upon, or over which, they lived while the continental areas were in process of elevation. The waters of the districts thus inclosed and elevated above the level of the surrounding sea became first brackish, and then fresh, in consequence of the influx of fresh water from the drainage of the surrounding land, and a consequent outflow into the open sea. Those of the sea-born animals which became thus inclosed, and which were capable of conforming to the new conditions, did so, and peopled the river systems which were produced in connection with, and which succeeded, these fresh-water lakes. Those which could not thus conform to the new conditions became extinct; and as these appear to have constituted the larger part of every fauna which became land-locked in the manner referred to, we may reasonably conclude that the lines of descent of many of the groups of marine animals have been broken by this means.

River systems have resulted upon the disappearance, by final drainage, of the fresh-water lakes just mentioned, the inlets having

been prolonged across the former lake bed as upper branches of the system, the former outlet becoming the main stream, and the whole a finished river system, with its fauna derived from the lake in which the system originated.

It is a well-known fact that many fishes, in connection with their breeding habits, pass from marine to fresh waters, and return to marine, with entire indifference to the change. Again, some existing so-called land-locked fresh-water fishes are believed by naturalists to have become such by choice, or by a failure on their part to continue their periodical returns to the sea where their kind originated, even when there was no apparent physical obstacle to their returning. It is probable that many similar cases have occurred in former geological periods, and also probable that a few mollusks and other invertebrates have, during those periods, in like manner changed from a marine to a fresh-water habitat; but I believe that, as a rule, fresh-water faunas have primarily become such by compulsion, in the manner that has just been suggested.

Admitting this proposition, we need not attempt to trace the genetic lines of fresh-water fishes as such any further back than the time of the compulsory land-locking of their progenitors; but this would not forbid speculation as to what kinds of marine fishes the fresh-water forms originated from.

It is possible that, in cases of sinking beneath the sea of land areas, upon which fresh waters with their faunas had become established in former geological periods, the sea has reclaimed and preserved alive some of its previously alienated mollusks and fishes; but this is a matter concerning which we can, at best, make only vague conjectures.

The reason why the animal life of fresh waters is so meagre, as regards the number and variety of kinds which they contain, when compared with the teeming and diversified life of the sea, are various. First, the presence of sodium-chloride and other salts in water has evidently been conducive of evolutional differentiation; and there can be no doubt that common salt has played a remark-

ably important part in the evolution of the different forms of animal life which have existed upon the earth. Second, in those cases of land-locking of marine animals by a rise of the sea bottom in the manner already suggested, only a part of the fauna then existing there would probably have become inclosed, because many of them would no doubt have escaped into the outer sea before they were fully surrounded by land. Third, only a part of those which were finally land-locked were able to survive the change from salt to fresh water. Fourth, a large proportion of marine gill-bearing animals appear to be, and always to have been, wholly incapable of living in fresh water.

Among those marine animals which seem to have been wholly or mainly incapable of surviving a change of habitat to fresh waters, and which, we may assume, did not escape land-locking, together with the other forms, in the numerous cases of the kind which have occurred in past geological periods, are several of the entire comprehensive groups into which the animal kingdom is divided. For example, we learn from the study of existing faunas that, with the exception of a few inconspicuous forms of the Cœlenterata, which are so abundantly represented in marine waters, this important sub-kingdom is not represented in any fresh waters; also, in fresh waters the entire classes, Echinodermata, Tunicata, Brachiopoda, Pteropoda, and Cephalopoda, are without any known representation. Besides these large deficiencies in fresh-water faunas, as compared with those of the sea, there are numerous minor, but no less important, deficiencies, occasioned by the entire absence of a considerable number of orders and families, as well as parts of others.

It would doubtless be unsafe to say that any of those animals could not possibly have survived a change to a fresh-water habitat; but there is much reason to suppose that they possess some inherent quality, which has prevented the survival of their ancient representatives, whenever their habitat may have been changed from a marine to a fresh-water condition. Indeed, if such changes of aqueous condition had been effected suddenly, it is probable that

none of the marine animals having aqueous respiration, which may have been thus inclosed by the rising land, would have survived in any instance. The comparatively few forms that did survive in fresh waters doubtless had much time in which to conform to their gradually effected new conditions.

It is probable that air-breathing mollusks have all been originally derived from those of aqueous respiration; and that this important change, and a consequent necessary change of habitat, has been accomplished mainly by a process of natural selection which was voluntary on their part, as compared with that by which the gill-bearing mollusks are assumed to have survived the change from salt to fresh waters. Again, that the air-breathing mollusks are confined to the class Gasteropoda, while other mollusks have evidently had equally good opportunities to become air breathers, is a significant fact, but one which, like that of the origin of the air breathers, I cannot discuss at this time.

While we may not doubt that the whole of the existing life of the globe has come down from former geological periods in unbroken genetic lines, the fact has not been demonstrated by tangible evidence; and it is well to consider briefly some of the causes of the imperfection of the geological record in that respect. By an investigation of this subject, we shall find that, while a multitude of such lines have certainly terminated at various periods before reaching the present time, it is not necessary to infer that any of them have been imperfect simply because we have not found the proof of their continuity in the shape of fossil remains. The lack of such proof is due to various causes. For example, only the hard parts of animals are capable of fossilization, and many animals have no hard parts. The greater part of the fossiliferous strata of the earth, which now exist as such, are not, and never can be, accessible to human investigation; and a vast amount of fossiliferous rocks, now classed as Azoic, may have once contained abundant remains of animal life, but which have become completely obliterated by metamorphism or other causes.

Finally, even the hard parts of animals, and especially those of land animals, are, and always have been, subject to rapid decomposition when exposed to atmospheric influence, although they may be preserved indefinitely when buried beyond the reach of such influence. It is this rapid destruction of the remains of land animals which is largely the cause that their geological history is so incomplete as compared with that of marine life.

An illustration showing how rapidly traces of important land faunas may have disappeared in former geological times is furnished by the living bison, or buffalo, of North America. Perhaps the earth has never witnessed such enormous numbers of any one species of large animals occupying such a broad continental area, as in the case of the buffalo. Its range once extended from the vicinity of the Atlantic to the mountains which border the Pacific coast, and from México to near the Arctic circle, and its numbers were so great, even within the last twenty-five years, as to impede travel across the great plains of the West. So rapidly is this animal now passing away that it has disappeared from all but a fraction of its former range; and I venture the prediction that there are persons now living who will witness its entire extinction in its free state. It is true that relentless man has brought about this wholesale destruction, but that does not alter the force of the application I wish to make of the fact that the buffalo is passing away and leaving, by natural means, hardly any trace of its former existence. In all that region where it has lived so many centuries in abundance, traces of even its bones and teeth are rarely found.

Few places in all its former wide range have furnished the conditions necessary for the preservation, by sedimentary interment, of the bones of the buffalo beyond the reach of atmospheric influence; and the result has been that they have generally disappeared by decomposition as completely as the flesh has done. It is doubtless in a similar manner that the other great terrestrial faunas have been destroyed in former geological periods, for the remains of terrestrial animals have not usually fallen in conditions at all favora-

ble to their preservation, as compared with those of aqueous animals, which have had almost immediate sepulture.

I fear that in consequence of these remarks, following those with which I began to address you, some will be ready to suggest that naturalists have insecure ground to base their generalizations upon, as regards the origin of the existing animals of the earth by lineal descent from extinct faunas. I fully recognize the danger, in such an address as this, of giving undue prominence to the doubtful side of the subject. It is difficult also to satisfactorily present the affirmative side in a brief and concise manner, because that side is supported by evidence which is cumulative in its character, rather than reducible to precise propositions.

My object, however, in showing how completely great faunas may have been destroyed in past geological time is to plausibly account for the absence of their remains in places where our methods of reasoning lead us to expect them; and also to show that, because their remains have never been discovered, we should not necessarily infer that the animals which were necessary to complete a regular genetic scale never existed. Indeed, the fact that certain breaks in the zoological scale occur at certain horizons of the geological scale ought to lead us to infer that the missing animal forms did exist somewhere at such times, rather than that they never existed at all.

Now, as the study of the genetic descent of animals through geological time is based upon plan of structure, and the methods by which form is expressed, these indications may be ranged under two heads, namely, similarity of structure and identity of type. The former is a matter of tangible details, but the latter is in some sense ideal, or a manner in which form, in connection with structure, is expressed. The former is material in its character, but the latter is not the less real and important to the naturalist in the philosophical study of the comprehensive groups of animals.

The word "type," like many other words in the English language, is used with a variety of meanings; and as I use it here in a special sense, I may be excused for adding the following

words of definition: I regard a type as an ideal representation of a group of species which may embrace the whole of a comprehensive genus, or possibly more; or it may be only a subordinate division of a genus. I do not use the term as interchangeable with any of the terms which are used in systematic classification, such as species, genus, family, &c.; but sometimes it may be equal in scope to any of them, as, for example, when only a single species of a genus or of a family is known. It may, however, be properly substituted for species, genus, &c., in cases where, as in the Ostreidæ, for example, specific and generic diagnoses cannot be satisfactorily made. I shall, in the following remarks, have somewhat frequent occasion to refer to types, as just defined, and to their persistence through the geological periods, for I shall assume identity of type to be proof of lineal descent.

The fact that genetic lines of descent among animals have come down to the present time through successive geological periods being admitted, we may next inquire as to the manner in which they have been preserved, or rather how some of them may have escaped destruction during the physical changes which have occurred since those lines were established. I must necessarily make occasional reference to marine faunas in the following remarks, but it is my present purpose to discuss only those terrestrial and fresh-water faunas, the remains of which are found within the present limits of North America.

The manner in which lines of descent of the various families and types of animals have been preserved through the geological ages, and in which their perpetuation has been secured, has necessarily been different in the case of different kinds of animals. The sea having always occupied the greater part of the earth's surface, notwithstanding the shiftings of land and sea, which have, from time to time, taken place ever since land and sea first appeared upon the earth, one may readily understand how unbroken perpetuity of marine life may have been secured from the earliest dawn of life to the present time. It is not to be doubted that numberless lines of

descent of marine, as well as of land, animals have terminated during past geological periods, both from catastrophal and cosmical causes; but we may reasonably assume that all the multitudinous forms which people the sea to-day have been derived by direct lineal descent from those earliest forms which the sea contained at the dawn of life upon the earth. At least, if this has not been the case, there is nothing in the nature of the proposition that makes it improbable; that is, there have been no such changes upon the earth since life began as would at any time have necessarily destroyed all, or any considerable part, of the marine life previously existing.

The lines of descent of land animals have, however, been subject to greater vicissitudes; and the conditions under which they have originated and been perpetuated have been more various than those which have prevailed in the sea. Still, one may readily understand how land animals, which may have occupied a given region of the earth at any geological period when the physical conditions of the land which they occupied were changing, may, by their power of locomotion, have shifted to more congenial places, because, as a rule, such changes have not been too rapid to hasten unduly even the proverbially slow-moving snail. Thus land and palustral air-breathing mollusks, although they all require a moist habitat, could easily migrate to other congenial ground, as the land they were occupying may have become too dry for them or may have subsided beneath the sea. Therefore, their migration has always been practically unrestricted; and if, as is believed to have been the case, continental areas have been continuous, though subject to material changes and shiftings from early geological times, there appears to be no reason why, at least, many genetic lines of those animals should not have been continued from those ancient times to the present.

The case has been quite different as regards true fresh-water fishes and fresh-water gill-bearing mollusks, all of which can, of course, exist only in fluviatile and lacustrine waters. When we consider how

extensively the earth's surface features must have been changed during the successive geological periods, it would at first sight seem impossible that continuous lines of descent of such animals as these could have been preserved through any considerable portion of them. That is, those gill-bearing animals which may have occupied any given river system could not effect their distribution, or even their preservation, by migrating beyond its limits, in case their habitat should be destroyed by movements of the earth's crust. They could not pass over the land to any portions of other river systems, nor could they pass through the sea to reach the mouths of other rivers. We have, however, very satisfactory evidence that a large part of the living gill-bearing animals of North American fresh waters have come down by unbroken genetic lines from some period at least as remote as the close of the Cretaceous.

Now, a continuity of these lines of descent necessarily implies a continuity of their fresh-water habitat from the time of the origin of those lines to the present time. This continuity again implies the integrity of those river systems in which the mollusks originated, from those early times to the present. This last proposition, as a geological one, is comparatively new; but the labors of Powell, Gilbert, and Dutton have shown that rivers, in many instances at least, have been among the most permanent of geological, as well as geographical, features; that even the elevation of mountain ranges across their course has not swerved them from their ground; but that they have cut their way through the ranges as fast as they arose.

A vast number of rivers, which have drained the land in past geological times, have undoubtedly been destroyed by the submergence of the land and other causes; but I think we are justified in the assumption that many of the streams which were established, even as far back as the close of the Cretaceous period, are still flowing as parts of existing river systems. In this way, a large part of the gill-bearing faunas of the rivers of to-day have, by direct lineal descent, and in unbroken habitats, been transmitted from long past geological periods.

As to the manner in which the great vertebrate and articulate land faunas which now exist, and which have existed in former geological periods, have been respectively developed from lower forms, I have, at present, no suggestions to offer; but it is, nevertheless, assumed that they have been thus developed. It may be remarked, however, concerning their origin and perpetuation, that while certain minor faunas of terrestrial animals may have originated and been perpetuated upon comparatively small areas, it seems certain that the development and perpetuation of the great reptilian faunas, which existed during Mesozoic time, and also that of the wonderful mammalian faunas, whose remains are found in Tertiary strata, required large and congenial continental areas. It also seems necessary to infer that those continental areas, although they, from time to time, suffered material losses, and received considerable accessions of land, have been of true continental dimensions from early geological time.

The general subject of the geological history of continents is so complex and far reaching, and our present knowledge of that subject so fragmentary, that I shall not now attempt even an outline of such a history for North America; but I shall confine myself to what I conceive to be some of the more salient points of that history from a biological standpoint only.

If the geological history of animal life is incomplete and fragmentary, a like history of continental areas, especially as regards their location and outlines at different periods, is much more so. In the former case, we are guided in our investigations and conclusions by a known zoological system, which is based upon the abundant and diversified existing life of the earth. In the latter case, we are apparently without any available systematic guide; and the various phases of geological history of continents seem to have been the result of fortuitous movements of the earth's crust, in connection with sedimentation and sub-ærial and aqueous erosion. Not that those movements and processes have not been governed by physical laws, but the events, so far as we have yet learned in-

dications of them from the study of existing continents, appear to have lacked such relations with each other as to give any satisfactory history of continuous continental growth.

The opinion has prevailed among geologists that the North American continent, as a whole, had its origin as a result of the gradual contraction of the mass of the earth, by which certain depressions and elevations were formed upon its crust. The former, it has been understood, became permanently the ocean beds; and the latter, gradually rising above the level of the sea, became continents, whose outlines were changed, from time to time, by continued elevation, alternating with greater or less depressions; and also by coalescence of previously separated parts, and by accretions upon, and erosion from, their borders. This opinion implies that continental areas were pre-determined, that they have been permanent in their location, and that no such areas have ever occupied the broad spaces which are now occupied by the great oceans.

I do not now intend to discuss this theory, but I may say in passing, that a number of important facts do not, in my judgment, agree with it, and I regard it as more probable that continental areas have shifted from place to place in past geological time. But without reference to that theory, certain known geological facts seem to show that the present continent arose from the sea in separate portions, the larger and older being its northeastern portion; and that the western portions were elevated afterwards, and finally coalesced with the eastern. Furthermore, that the continent reached its present dimensions and shape by more or less extensive accessions upon its borders, especially those of the great gulf and the Pacific ocean.

While the following remarks will mainly refer to animal forms, certain known facts concerning the vegetable life of the past are so important in this connection that they should be at least briefly mentioned. If we regard the graphite which has been found in the Archæan rocks, and the petroleum of Silurian strata, as having had their origin in land plants, the history of the land vegetation of the

continent begins much further back than the earliest period in the strata of which we have yet discovered any indications of land animals. It is probable that land animals of the simpler kinds co-existed with the first established land vegetation; but with the exception of some imperfect remains of a species of land snail, and those of a few insects, which have been found in Devonian strata, the remains of the earliest known land animals have been found in strata of Carboniferous age. These Carboniferous land animals comprise a few batrachians, insects, and air-breathing mollusks; and although they are so few, they evidently represent portions of a large and varied fauna which then existed. They are also so highly organized and so diversified in character as to indicate that they originated in genetic lines which began in earlier periods, more or less remote.

The Carboniferous air-breathing mollusks referred to are both land and pond snails, and they have been found in widely separated portions of North America. They all belong to types which are represented by mollusks now living upon this continent, and by those also which are known to have existed here at intervening periods. These facts seem to indicate plainly that land surfaces of considerable extent have been continuous from that early period to the present; but they tell us nothing yet of continental movements which may have taken place in the meantime.

Our knowledge of the relations of the different portions of living non-marine molluscan faunas would naturally lead us to suppose that fresh-water gill-bearing mollusks existed simultaneously with those ancient air-breathers. Nevertheless, with the exception of certain bivalves, which have been found in Devonian strata, and others in the Carboniferous, which have been doubtfully referred to a fresh-water origin, fresh-water gill-bearing animals are not known to have existed before the beginning of Mesozoic time. It is, however, reasonable to suppose that such animals did exist in Paleozoic lakes and rivers, although no satisfactory traces of them, or of such bodies of fresh water, have ever been discovered.

As regards Paleozoic fresh-water fishes, they may or may not have existed. According to our present knowledge, teliost fishes, although they have been so abundant in both fresh and marine waters ever since Mesozoic time, had no existence in Paleozoic time. Marine ganoids were then abundant, and the Mesozoic, Tertiary, and living fresh-water ganoids may have been derived from some of them by lineal descent through fresh waters, but they probably originated by land-locking from the sea during later periods.

Viewing the animal and vegetable life of the earth as having been expressed in continuous series of forms, we ought not to expect to find that the geological ages were separated from each other by hard-and-fast lines, as regards the fossil remains of those series which characterize the strata of each age respectively. When such lines appear to be distinct, I think we are justified in assuming that the geological record is incomplete; or, in other words, that the forms necessary to complete that portion of the series really existed at the close of the one age and the beginning of the next; but that they are not represented by any discovered fossil remains.

The division between the Paleozoic and Mesozoic of North America, so far as the geology and paleontology of the continent is yet known, is much more distinctly marked than it is between the Mesozoic and Tertiary. This is especially true as regards plants. The greater part of the peculiar forms which characterized the abundant vegetation of the Carboniferous age seem to have suddenly ceased to exist with the ushering in of the Mesozoic age; and no representative of the dicotyledonous flora, which was so abundant in the Mesozoic and Tertiary, and which is so preponderant upon the earth now, has ever been discovered in any of the Paleozoic strata of the earth. From an evolutional standpoint, however, we cannot suppose that such an extensive and highly organized flora came suddenly into being; and we are left to infer that it was gradually developed somewhere, and during a period prior to that which is represented by the strata which contain the earliest known remains of the kind. The small number of land animals, that are

known to have existed in those early periods, do not seem to indicate so distinct a separation of the Paleozoic and Mesozoic as the plant remains do; for the types of the former have come down to the present day. The land snails, before referred to, furnish remarkable examples of types of animal life which have passed from the Paleozoic to the Mesozoic age, and thence down to the present time.

Although the biological evidence seems to be conclusive that, from the earlier Paleozoic to the present time, considerable portions of land have been continuously above the level of the sea within the area which is now occupied by the North American continent, we have no indication from such evidence as to the shape and dimensions which those early land areas successively assumed. We are, however, justified in the opinion that some of them were of great extent. From a biological point of view, also, I regard it as probable that extensive land areas formerly existed adjacent to that which the present continent occupies, and that they have been lost by submergence and erosion. This opinion, I think, derives strong support from the apparent sudden beginning, and the equally sudden termination, of certain extensive faunas of highly organized land animals, which are known to have existed and become extinct.

I do not forget, however, that our knowledge in this respect is slight, and that it is possible that the progenitors of these faunas may have existed within the bounds of the present continent, and that their remains may have been destroyed, so as to have escaped the scrutinizing search that has been made for them. But in view of all the known facts, both geological and biological, I at present hold to the opinion just expressed.

The existence of the immense and diversified dinosaurian faunas of Mesozoic time, subsisting, as they did, largely upon vegetation, seems necessarily to imply the co-existence of large land areas: also their apparent sudden introduction at the beginning of that age seems to make it necessary to conclude that their progenitors existed somewhere before the close of Paleozoic time, although no remains of those progenitors have been discovered. Because no

trace of the progenitors of either the dinosaurian faunas or dicotyledonous floras of the Mesozoic age have been discovered in previously existing strata, I am disposed to conclude that those progenitors originated upon, and occupied, land areas, which became gradually submerged, together with their ancient faunal and floral remains; while their living successors escaped by migration and dispersion to adjacent and unsubmerged portions of land, which are now within our continental area.

There is reason to believe that during the Triassic and Jurassic periods large continental areas were above the level of the sea, within and near the present limits of the North American continent; but we know comparatively little of the terrestrial life of those periods from actually discovered fossil remains.

If we except the Paleozoic bivalve mollusca of supposed fresh water origin, which have already been referred to, the remains of the earliest fresh-water molluscan fauna, of which we have any satisfactory knowledge, are found in Jurassic strata. These Jurassic mollusks belong to well-known types now living in the fresh waters of this continent; and they are also so highly organized as to point back to a still more ancient period, as that of their origin. These mollusks suggest the existence during the Jurassic period of fresh-water lakes and rivers within what is now Western North America, and the lakes and rivers in turn suggest the existence then of a considerable continental area. It is possible that those Jurassic rivers were, in part, portions of river systems which had held a persistent existence from former geological periods; but we have no direct paleontological evidence of it. This gill-bearing molluscan fauna seems also to be ancestrally related to faunas which are known to have existed in subsequent periods, as well as to certain fresh-water mollusks now living in North America.

A few species belonging to the fresh-water family Unionidæ have been discovered in Cretaceous strata of the western portion of this continent, but they all appear to be of different types from any of the family now living. I take this to be an indication that the

fresh waters in which those Uniones lived were not continued to later periods, as some other ancient streams of fresh water were, together with their molluscan faunas, and that the lines of descent of those mollusks were consequently cut off and their types extinguished.

While many rivers have persistently held their ground through several geological periods, despite even the elevation of mountain ranges across their course; the fact that great numbers of them have been destroyed in past geological time by the physical changes which have taken place in the regions they have occupied, is too evident to be questioned. One of the many examples of the destruction of bodies of fresh water which have become established upon the earth in former geological times is suggested by the presence of a true estuary deposit among the Cretaceous strata of Northern Utah. This deposit, which is a rare one of the kind, was evidently formed at the western border of the oceanic belt, which, it is understood, then traversed the whole North American area in a northward and southward direction, between two separate continental areas, and at the mouth of a river which then drained part of the western area. The region which that oceanic belt then occupied is now the heart of the continent, and all traces of the ancient river referred to are obliterated. Furthermore, the district which it drained to the eastward is now drained by other channels running in the opposite direction, into the Salt Lake Basin. I shall presently have occasion to refer again to this estuary deposit and to others which no doubt co-existed with it along the shores of the same sea.

The period which immediately succeeded that in which the last of the marine Cretaceous deposits were made, and which contains the estuary deposit that has just been referred to, namely, the Laramie period, witnessed the production of one of the most remarkable features which has ever characterized any continent. This feature was a great inland sea, holding both brackish and fresh waters, as the Caspian does now, but which was in other respects more like

the Black sea, because the latter has an outlet. It was immensely larger than either, but its full size is not known. Its deposits, however, are now found to occupy large districts, at intervals from Northern Mexico to the British Possessions, and from near the meridian of Great Salt Lake to western Kansas and Nebraska. It occupied the region which, in the immediately preceding period, was occupied by the oceanic belt before referred to. This belt was changed from an oceanic condition to that of an inland sea, by such a rise of the sea bottom at both the northern and southern portions of the belt as connected together the eastern and western continental areas, and gave the inclosed sea its inland position upon the great united continent.

That the waters of this great inland sea were soon considerably freshened, is shown by the fact that its deposits contain no remains of true marine forms. That its waters were in part brackish, is shown by the presence of the remains of a large variety of forms similar to those which now inhabit brackish waters only, and that they were in part fresh, is shown by the presence of fresh-water forms. A commingling of brackish and fresh-water forms is sometimes found in the strata of the Laramie group, but usually the two kinds are found respectively in alternating layers. This last named fact indicates that there were, from time to time, such oscillations of the bottom of this sea and its surrounding shores, as shifted the salt and fresh-water areas respectively, so that their deposits locally alternated with each other. And yet sedimentation in the Laramie sea went on continuously from the time when it was a part of the open ocean, and also continuously into parts of the fresh-water lakes which succeeded it.

That this great inland sea contained, at times, broad islands, and extensive marshes covered with a luxuriant vegetation, is shown by the abundant beds of lignite and other vegetable remains; and that its marshes were peopled by great dinosaurs and other reptiles, is shown by their remains, which are now found in various portions of the Laramie group. That many fresh-water streams emptied into

this great inland sea from the surrounding land, and that the sea had at least one great outlet, are necessary conclusions.

Now, the waters of the oceanic belt, which immediately preceded the Laramie sea, contained an abundant marine fauna, a large part of which necessarily died by the subsequent freshening of the waters, and in consequence of this, as we may suppose, many lines of genetic descent were broken. The surviving faunas were able to thrive in brackish and fresh waters respectively, both of which, as already stated, the Laramie sea contained. That the brackish-water forms, which survived in the Laramie sea, originated in the estuaries which existed upon its borders, before that sea was cut off from the open ocean, is probable, from the fact that those forms are largely identical in type with certain forms which are known to have existed in the same region just prior to the Laramie period. That the progenitors of the fresh-water Laramie species may have occupied some of the streams which emptied into the sea before it became land-locked is probable, but I regard it as also probable that they originated, at least in large part, in the Laramie sea.

Accepting the conclusions which have just been expressed, concerning the former existence and the character of the Laramie sea, which conclusions I have reached from a biological standpoint, we obtain a remarkably comprehensive view of the conditions which prevailed, during the Laramie period, upon what was destined to be our continent. There rises before the imagination of the investigator—an imagination chastened and curbed by a rational interpretation of facts—a great continent, whose outlines, it is true, are hidden in the mists of uncertainty; but he sees, resting upon its broad surface, an inland sea, the like of which for magnitude the earth has never known before or since. On every side stretches away a broad expanse of comparatively level country; a few mountains are seen in the distance, but not a peak of the great Rocky Mountain system has yet arisen. The land is covered with verdure and diversified by forests of wonderful growth; the busy hum of insects fills the air; the bright scales of fishes gleam in the waters of the sea;

huge terrapins crawl upon its beaches, and the jungles along its shores are peopled by a strange fauna, of which the dinosaurs are chief.

At the close of the Laramie period, there were such movements of the earth's crust as to change to dry land the greater part of the bottom of the Laramie sea, and the remainder was occupied by large bodies of water, greatly larger than our present great lakes, which then became wholly fresh, and so continued through a large part of the Tertiary period. It is in the deposits which those great fresh-water lakes have left that have been found the remains of the wonderful mammalian faunas, which have become so celebrated in North American geology. Other faunas, equally wonderful, have probably existed elsewhere, which have shared the fate that is now overtaking the buffalo, and that might have overtaken those Tertiary animals also, were it not for the very favorable conditions for entombment of their remains, which the sediments of those lakes afforded.

Up to the close of the Laramie period, through the whole of which a large dinosaurian fauna was continued, and in the strata of which there is a commingling of Cretaceous and Tertiary types, we have no evidence, in the shape of fossil remains, of the existence of any mammals except about a dozen small marsupials. The Eocene Tertiary strata, which rests directly upon those of the Laramie group, contain the remains of a mammalian fauna, which, for magnitude, diversity, and high organization combined, has never been excelled upon the earth. Nevertheless, we know nothing of the ancestry of this great fauna, so far as fossil remains are concerned, although the geological series of the preceding formations is quite complete; and those formations have been carefully searched for such remains. The dinosaurian fauna of the Laramie period seems to have ceased as suddenly as the mammalian fauna was introduced.

Since faunas have originated under favoring, and become extinct under adverse, conditions, the subject of the extinction of faunas is quite separate from that of their origination, although they are

in this case brought into immediate juxtaposition. The great dinosaurian fauna of the Laramie period doubtless originated much earlier, and came down under continuously favorable conditions from the earlier Mesozoic periods, and which favorable conditions were not interrupted by the land movements by which the Laramie sea was inclosed. Their final extinction appears to have resulted from an unequal struggle for existence, which ensued upon the introduction upon the land they had previously occupied of the immense mammalian horde whose remains are found in strata immediately overlying those which contain their own. The mammals thus became the leading forms of life upon this continent, as it then existed, as the dinosaurs had been during Mesozoic time.

For reasons already stated, we assume that the progenitors of this great mammalian fauna, whose appearance upon the earth seems to have been so sudden, really existed somewhere long previous to the time which is represented by the strata in which the remains referred to are found. I regard it as probable that those progenitors occupied some continental area, adjacent to that which the present one now occupies, and which, after the migration of the fauna to the region where their remains are now found, superimposed upon those of the dinosaurs, became destroyed or submerged.

It does not seem to me probable that this mammalian fauna could have previously occupied either the eastern or western portion of North America, as they are understood to have existed then, because those portions were already united at the beginning of the Laramie period, when the Laramie sea was formed, and their earliest known remains are found in strata which were deposited after the close of that period; that is, I hold that the known facts warrant the opinion that the immediate predecessors of the Tertiary mammalia referred to, themselves of Tertiary types, originated and long existed contemporaneously with the dinosaurian fauna of the Laramie period, but in a land which was separate from that which the latter occupied. Furthermore, that the land area which the mammalia then occupied is now unknown; but that it became united to the

dinosaurian region, as one of the results of those land movements by which the Laramie sea was destroyed.

I am well aware that this proposition is not fully established, but the series of strata preceding those which contain the mammalian remains is so complete as to indicate the prevalence of conditions, through at least the whole of the Laramie period, which were as favorable for mammalian existence as those of any subsequent period. And, although that series of strata has been quite as fully investigated as any other strata of the west, no trace of the ancestry of the mammalian fauna referred to has been discovered.

The immediate superposition of the remains of the mammals upon those of the dinosaurs, at the junction of the two formations which contain them respectively, indicates that the two mighty faunas met upon the same ground, in a contest for supremacy, which was decided in favor of the mammals, and that the dinosaurs then disappeared from the face of the earth. That this veritable "battle of the giants" was sharp and decisive, is probable, from the fact that there is no such association of the remains of the two faunas as to indicate that they lived together any considerable length of time.

Other strange and interesting land faunas succeeded those mammals which have just been referred to, but time will not permit me now to speak of them. I will therefore close my remarks with some reference to the manner in which, as I conceive, a large part of the gill-bearing fauna of the Mississippi river system has originated, effected its descent to the present time, and attained its present broad distribution.

The close similarity which exists between the molluscan fauna of the Laramie group and that of the present Mississippi river system, is apparent even upon casual observation. A large proportion of those mollusks are not only of the same types in each fauna respectively, but it is difficult to say how some of the fossils differ specifically from the living forms. This resemblance is strikingly exemplified among the Unionidæ. Those of that family now living in the Mississippi river system comprise a large variety of peculiar

forms, differing so much from those of other parts of the world that they are designated among naturalists as "North American types." The Uniones of the Laramie group, of which a considerable number of species have been discovered, are mainly of these North American types, and I, therefore, conclude that these fossil forms represent the living ones ancestrally. This conclusion of course implies that there has been an unbroken habitat for those fresh-water mollusks, from the Laramie period to the present time. Accepting this conclusion, we necessarily understand that the outlet of the Laramie sea continued to flow as a river after the disappearance of that inland sea and down to the present time, and that that river is now the Missouri, or one of its tributaries. The Laramie deposit also contains the remains of certain ganoid fishes, which are closely related to the gars (*Lepidosteus*) and dog-fishes (*Amia*) of the Mississippi, and the fishes doubtless effected their descent in the same waters with the Uniones.

If geologists have read the later history of the North American continent correctly, we learn that at the time those ancient inland bodies of water existed, the great Southern Gulf extended so far to the northward that it probably received the outlets of those bodies of water as separate streams. The same conditions would also have made the Ohio and Upper Mississippi separate rivers, emptying by separate mouths. While these two last-named rivers were separate from the western one, which drained the lakes and the inland sea, they doubtless had faunas which were quite different from that which now characterizes them. When, by a recedence of the borders of the gulf to the southward, all those rivers united their waters to form the main stream of the Mississippi, it is easy to see how the ancient fauna, which had come down the Missouri branch, may have become dispersed throughout the great river system.

I have thus endeavored to point out from among the great mass of evidence of the existence of life upon the earth during successive geological periods what portions of that evidence have reference to then existing land areas, for the bulk of it tells us of the ever

present sea. I have tried to indicate some of the relations which those areas probably had with our present continent, and to draw intelligible inferences, from the character of the fossil remains which represent some of the early forms of life, as to the conditions under which those forms then existed, and their relations to the now existing life of this continent. I have also offered suggestions concerning some of the changes of land and sea which, from time to time in the past, have probably taken place within and near the great area which is now occupied by the North American continent, and I have spoken also concerning what seem to be the results of those changes upon the life then existing, as well as upon that which now exists.

If my remarks shall have seemed in some respects desultory, I may, perhaps, claim that the nature of my subject has made them so. If, in the absence of tangible proof of the ancestry of some of the highly organized faunas and floras, whose remains are found in the strata of the different geological periods, I have assumed that such evidence has once existed, but that it has been destroyed or undiscovered; if, in attempting to explain these discrepancies, I have ignored the possibility of special creations—a belief which I am well aware is still popularly held—I have done it with no irreverent or antagonistic intent. As a naturalist, I must accept only natural explanations of natural phenomena. That I may have erred in judgment with regard to these questions, it would be folly for me to deny; but I claim to have been actuated in my study of them by a desire, which is the attribute of every true naturalist, to know the truth and the truth only. If you should not be disposed to accept the conclusions which I have reached, surely the facts I have stated cannot fail to interest you.

The subject which embraces these facts is an exceedingly broad one, and upon them may be based other discussions than those which I have attempted. Other lessons may also be drawn from them, one of which is that, in the accomplishment of her ends, Nature is extravagantly wasteful, and terribly cruel.

And yet, there is so much of order and harmony apparent in all her ways, so much of the genial sunshine of knowledge gained to the naturalist who studies them that, with the optimism which is inseparable from a sound mind in a healthy body, he has an enjoyment of his occupations such, I believe, as other men rarely know.

NOTES ON NORTH AMERICAN PSYLLIDÆ.

By C. V. Riley.

(Read May 25, 1883.)

Having been engaged lately in putting together the material for a study of the Psyllidæ of North America, I would, in this brief paper, offer a preliminary statement of some of the results, and append a few descriptions of the more remarkable forms for publication in the proceedings.

Knowledge of the European Psyllidæ has greatly advanced, both as to morphology and biography, since the time of Linnæus and Latreille, mainly through the labors of Hartig, Förster, Flor, and more especially, in recent years, through the important publications of Dr. Franz Löw, of Vienna. The Psyllid fauna of the United States has, however, received little attention from American entomologists; yet it is rich in species which are of great interest.

What has hitherto been done in the classification of the North American Psyllidæ may be gathered from the following list of the species actually described. A similar list was published in the "Canadian Entomologist" by Mr. Wm. H. Ashmead, (1881,) but it was somewhat incomplete, and contained some inaccuracies.

1. *Diraphia vernalis* Fitch.
2. *Diraphia femoralis* Fitch.
3. *Diraphia calamorum* Fitch.
4. *Diraphia maculipennis* Fitch.
5. *Aphalara arctica* Walker.
6. *Psylla ilecis* Ashmead.
7. *Psylla rhois* Glover.
8. *Psylla quadrilineata* Fitch.
9. *Psylla carpini* Fitch.

10. *Psylla annulata* Fitch.
11. *Psylla pyri* (Linn.), Harris, Fitch, Glover, *et al.*
12. *Psylla pyrisuga* (Förster), Barnard.
13. *Psylla venusta* O.-Sacken.
14. *Psylla celtidis-mamma* Riley.
15. *Psylla tripunctata* Fitch.
16. *Psylla rubi* Walsh and Riley.
17. *Psylla diospyri* Ashm.
18. *Psylla magnoliæ* Ashm.

Thus the number of described species amounts only to eighteen. All other names occurring in Ashmead's list and in Walker's British Museum list, as well as in cabinets, are manuscript names. Of the eighteen species, four are merely synonyms, while one is an importation.

The synonyms have been principally caused by the fact that the imagines of several species quite persistently occur on two or more widely different plants: thus *Psylla tripunctata* is equally common on Rubus and on Pinus; but while this is true of the mature insects, yet each species, so far as we yet know, is confined in its adolescent stages to one genus of plants, and often to one species.

According to the latest classification by Dr. Franz Löw in his paper, "Zur Systematik der Psylloden,"* our described species must be placed as follows:

I.—SUB-FAMILY LIVIINÆ.

1. *Livia vernalis*, Fitch, (synonyms: *Diraphia femoralis* F. and *D. calamorum* F.).
2. *Livia maculipennis*, Fitch. (*Diraphia maculipennis* Fitch.)

This sub-family, which has but two representatives in Europe, is at once recognizable by the flat, not prominent eyes, and by the form of the antennæ, the second joint being the largest.

* Verhandlungen der zoologisch-botanischen Gesellschaft in Wien, 1878.

II.—SUB-FAMILY APHALARINÆ.

3. *Aphalara ilicis*, Ashm. (*Psylla ilecis* Ashm.)

This sub-family was established by Löw upon genera in which the petiolus cubiti is as long as, or longer than, the discoidal part of the subcosta, and in which the frontal lobes are either absent or not separated from the vertex. Of the four European genera of this sub-family recognized by Franz Löw I have thus far seen American representatives of but one genus, viz: Aphalara, which appears to be well represented in the United States.

III.—SUB-FAMILY PSYLLINÆ.

4. *Calophya rhois* Glover.* (*Psylla rhois* Glover.)
5. *Psylla pyricola* Förster, (synonyms *Ps. pyri*, Harris, Fitch, Glover, etc.; *P. pyrisuga* Barnard.)

This is the Pear-tree Psylla of our northern and western States, and its reference to Förster's species is made after comparison with European specimens received from Meyer-Dür and Lichtenstein.

6. *Psylla quadrilineata* Fitch.
7. *Psylla arctica*, Walker. (*Aphalara arctica* Walk.)†
8. *Psylla carpini* Fitch.

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* It was one of Glover's boasts that he never described a species: yet on account of the marked colorational characters of this insect, he has unwittingly given, in two or three words, a recognizable description of it with figures. (Agricultural Report for 1876, p. 33, published in 1877.) The name conflicts with Fr. Löw's *Calophya* (*Psylla*) *rhois*, also published in 1877, (Abh. K. K. zool. bot. Ges. Wien, 1877, p. 148.) Without attempting to decide which of the two names has priority, but to avoid confusion, I would substitute for our North American species the name of *nigripennis*, under which Fitch described the species in his manuscript notes. Löw's description is a very careful one, while that of Glover is accidental and unintentional, the name being used under the impression that the species had already been described.

† This is described from Albany River, Hudson's Bay, (List of Homoptera, Brit. Mus., part 4, p. 931,) as an Aphalara. It is unknown to me, but Mr. Jno. Scott, (Trans. Ent. Soc. London, 1882, p. 459,) who has examined the types, declares it to be a genuine Psylla.

9. *Psylla annulata* Fitch.
10. *Pachypsylla* (n. gen.) *venusta*, Osten-Sacken. (*Psylla venusta* O.-S.; *Ps. c.-grandis* Riley.)
11. *Pachypsylla celtidis-mamma*, Riley. (*Pyslla c.-mamma*, Riley.)

The sub-family Psyllinæ which is characterized by prominent eyes, short petiolus cubiti, and by the frontal cones (when present) being well separated from the vertex, seems to be well represented in our fauna, but a large portion of our species cannot be included in the European genera. Of the ten genera into which Löw has divided the Psyllinæ, I have only been able to recognize two in our fauna, viz: Calophya Fr. Löw, and Psylla, as restricted by Löw. The former genus includes our two Sumac Psyllids, and a third of unknown habits, but presumably also living on Rhus. Of Pyslla a moderate number of species are in my collection, indicating the occurrence of the genus on both slopes of our continent.

Of the four new genera which I have recognized in our fauna, the most interesting appears to be that which includes our Hackberry Psyllids, interesting not only because of the peculiar structural characters exhibited in the larva and imago states, but more especially because of the fact that they are true gall-makers. I have called this new genus Pachypsylla, and append descriptions of it and of the principal species which it embraces.

IV.—SUB-FAMILY TRIOZINÆ.

Next to the Liviinæ this is the best defined sub-family of Psyllidæ, and it is at once recognizable by the prominent eyes, the long dorsulum and the absence of the petiolus cubiti. It includes the following species described from our fauna:

12. *Trioza tripunctata*, Fitch. (*Psylla tripunctata* Fitch; synonym: *Psylla rubi* Walsh & Riley.)
13. *Trioza magnoliæ*, Ashm. (*Psylla magnoliæ* Ashm.)
14. *Trioza diospyri*, Ashm. (*Ps. diospyri* Ashm.)

Of the genera described, only one, Trioza, has thus far been found in North America, but this genus is represented by numerous species. The venation of the front wings offers good characters for groups, while specific characters are best expressed in the genital armature of the male. Two species from Florida exhibit very remarkable structural characters which justify the establishment of two new genera here characterized.

In the following descriptions I have used those orismological terms which seem least likely to confuse, chiefly following Fr. Löw and other continental authors. The width of the head includes the eyes, and length measurements are from vertex to tip of closed wing.

Sub-family PSYLLINÆ.

PACHYPSYLLA, new genus.

Body very robust, transversely and longitudinally convex; in some species glabrous, in others finely pruinose with exceedingly short and sparse pubescence. Head large, vertical, vertex rugoso-punctate, longer than usual, but slightly or not at all narrowed anteriorly; anterior marginal line well marked, straight; frontal cones not in the same plane as the vertex, more or less oval, pubescent, vertical, about half as long as the vertex; anterior ocellus not visible from above; discoidal impressions punctiform or foveiform (*c.-gemma*); antennæ as long as (or even shorter than) the width of the head, stout, intermediate joints sub-turbinate. Pronotum of usual length (short in *c.-gemma*), steeply ascending posteriorly, rugosely punctate, of equal width, lateral impressions well marked, front and hind margins gently curved; dorsulum less developed than in the true Psyllas, more than twice as broad as long; sculpture of dorsulum and mesonotum varying according to species, either nearly smooth (*c.-gemma*) or alutaceous (*c.-venusta*) or rugoso-punctulate (*c.-mamma* and the rest of the species). Front wings varying in length and form according to species, flat (less so in *c.-gemma*), submembranaceous, and not rugose in the majority of the species (more leathery and rugose in *c.-gemma*), pterostigma more or less distinct, tip of wing between radius and fourth furcal and nearer to the costal than to the inner margin; petiolus cubiti much shorter than the discoidal part of the subcosta; marginal cells unusually long, narrow (less so in *c.-gemma*), and of nearly equal size. Metasternal processes shorter than in Psylla. Genital plate of male broad, convex at the sides, slightly lobed posteriorly, forceps simple; genital plates of female simple, of varying length. Legs stouter than usual. Larva and pupa with spinous tip of abdomen and sides of body not acute.

The species, so far as known, are all gall-makers, and confined to the Hackberry (*Celtis*).

There is no genus, among those characterized by Dr. Fr. Löw, with which Pachypsylla can properly be compared. In the convexity of the body it greatly surpasses Psylla, from which it is at once distinguished by the vertical and rugoso-punctate head, the quadrate vertex, the short frontal cones, the less filiform and stout antennæ.

Pachypsylla venusta (OSTEN-SACKEN.)

Average length, 5.6 mm. General color, brownish-yellow, variegated with darker brown, often with a greenish tinge, thorax with brown markings of the usual shape, front wings whitish speckled with brown, legs variegated with black. Head with the eyes narrower than the widest part of the thorax, vertical, slightly emarginate behind, vertex about one-third wider than long, nearly flat, not narrowing anteriorly, with anterior marginal line straight, slightly elevated along the inner margin of the eyes, surface rugoso-punctate, discoidal impressions punctiform, very distinct, median line fine; frontal cones below the plane of the vertex, vertical, very little longer than wide at base, rounded at tip and sides, not half as long as the vertex, and together only half as wide as the vertex, moderately divergent, rugoso-punctate, sparsely pubescent, and in color often brighter yellow than the vertex; antennæ as long as the head is wide, joint 2 a little longer than 1, joint 3 twice as narrow as 2 and but little longer than 4, the succeeding joints gradually decreasing in length, the terminal three closely conjointed, very little thicker than the preceding joints; each of the intermediate joints at tip a little wider than the base of the following joint; color, pale yellow, tips of intermediate joints and the whole of the last two joints black; terminal bristles very short. Pronotum moderately short, of equal width, slightly emarginate behind, steeply ascending posteriorly, sculptured and colored as the head; lateral impressions well marked. Dorsulum well developed, thrice as long as the pronotum and about twice as wide as long; posterior lobe distinctly longer than the anterior; hind margin sinuate each side and truncate at middle; surface finely alutaceous; color, light brownish yellow, with a large brown apical spot divided by a yellow median line. Mesonotum convex, wider than the head, sculptured as the dorsulum, with four vittæ (longitudinal) of brown or greenish-brown color, the outer ones usually wider than the inner ones, all bordered and divided transversely by lines of brighter yellow. Front wings two and one-third times longer than their greatest breadth, widest at basal half, whitish, semi-transparent, marked with brown, as follows: an oblique and gradually-diminishing band running from the tip of radial cell to middle of first furcal vein, more or less interrupted between, but persistent on the veins; a series of four large quadrate marginal spots at tips of furcals, a spot at base of pterostigma; paler specimens have these marks well relieved on a uniformly semi-transparent wing, while darker specimens have them more or less suffused with brown atoms, which often obscure the apical half of the wing and gradually intensify towards the posterior margin, where they always leave four clear, whitish terminal spaces between the veins, the fourth least distinct and sometimes obsolete; costal margin much rounded at base, thence straight, tip very narrowly rounded, nearly angulated, inner margin at terminal third rounded. Venation moderately strong, discoidal part of subcosta elevated into a prominent callus, pterostigma distinct, moderately long; petiolus cubiti as long as the stem of the first fork and one-half as long as the discoidal part of subcosta, which is as long as, or a little longer than, the basal part; radius nearly parallel to the stem of second or outer fork and fourth furcal, slightly curved upward at tip, all fur-

cals terminating very obliquely upon the margin, the first slightly shorter than the fourth, the second one-fourth longer than the first, which terminates at about the middle of the inner margin; stem of second fork as long as the third furcal; tip of wing distinctly between the radius and the fourth furcal; outer basal cell one-fourth shorter than radial cell; second marginal cell as long, but not quite as wide, as first marginal cell; margin of cubital cell as long as that of second marginal. Metasternal processes nearly twice as long as wide, constricted at base, apex not sharply pointed; legs yellowish gray, femora usually with the upper edge and a sub-apical spot blackish, claw-joint black. ♂: genital segment as long as the two preceding ventral segments together, wider than usual; color, yellowish brown, shining, with sparse, long pubescence; plate nearly as high as the length of the segment, wide, rounded and convex at the sides, provided with a distinct lateral lobe; anterior margin straight, posterior margin forming a nearly semi-circular line, greatest width at apical third; on its outer face the plate is convex and smooth anteriorly; the posterior lobe is rugose, and separated from the plate itself by a wide and shallow depression. Forceps two-thirds as high as the plate, front margin straight, hind margin slightly sinuate at basal half, tip rounded, outer face smooth and very shining.

♀: genital segment a little longer than the rest of the abdomen, opaque, brownish yellow with black markings, with moderately short and inconspicuous pubescence, upper plate gradually tapering apically and drawn out in a very sharp point, which is slightly turned upward; lower plate a little shorter than the upper, rapidly narrowing from the base and pointed at tip, but by no means as sharply as the upper plate.

Described from numerous specimens reared from a large woody gall formed on the petiole of the leaf of *Celtis*, a part of the base of the leaf being included, so as to form a groove on one side.

Pachypsylla celtidis-mamma (Riley.)

Average length, 4 mm. Color dirty yellowish-brown, frequently dark brown or brownish-yellow, upper side usually with a greenish tint; antennæ and legs yellowish, variegated with black; wings subhyaline and whitish, speckled with brown. Head and thorax more strongly rugoso-punctate than in *venusta*, opaque and with sparse, extremely short, but glistening pubescence. Vertex as in the preceding species, frontal cones more transverse; antennæ a little shorter than the width of the head, coloration and relative length of the joints as in *venusta*, intermediate joints more distinctly turbinate. Parts of thorax formed and colored as in *venusta*, a little less convex, and the brown color more predominant, with markings on dorsulum and mesothorax less clearly defined. Front wings narrower and, therefore, apparently longer than in *venusta*, very little wider at terminal third than at basal third; costal margin at base but slightly convex, at tip more broadly rounded; whitish, subhyaline, more or less densely covered with small, brownish, scale-like specks, as follows: an oblique and gradually narrowing band (extending from tip of pterostigma to near tip of radius), which runs across the wing to the tip of the first furcal, is usually freer from these dots than the rest of the wing, while its edges are usually more crowded with the dots, so as to bring the pale band into greater relief; quite frequently there is an intensified patch of brown about discoidal part of subcostal vein and at all vein furcations; also, the terminal space outside the pale oblique band is often uniformly dark, but with three marginal pale spots (one in each of the cubital, second marginal, and discoidal cells) always more or less distinctly relieved. This pale band is sometimes obsolete and the wing more or less evenly speckled; exceptionally, both inside and outside the oblique band, there is a border of variable extent, of a uniform dark brown color, not composed of small dots; pterostigma distinct, mod-

erately wide and long; petiolus cubiti a little more than half as long as the stem of first fork, and fully three times shorter than the discoidal part of subcosta, which is distinctly longer than the basal portion; radius nearly parallel to stem of second fork and fourth furcal, hardly curved upward at terminus, furcals terminating very obliquely upon the margin, third and fourth nearly equal in length, second very little longer than third, and first very little shorter than third, and terminating at about the middle of the margin; stem of second fork as long as third furcal; tip of wing between radius and fourth furcal; outer basal cell one-third shorter than radial cell, marginal cells of equal length, the second a little wider than the first. Metasternal processes pale greenish, cylindrical, hardly narrowed toward the tip, which is obtuse, not pointed. Legs pale brownish-yellow, femora usually variegated with black, last tarsal joint blackish. Abdomen either entirely blackish or brown, or brownish-yellow, in fresh specimens, suffused in pink.

♂: genital segment a little longer than the preceding ventral segment, brown, shining; plate as high as the length of the segment, lateral lobe barely indicated, anterior margin straight, posterior margin very slightly oblique, *i. e.*, the plate gradually increases in width toward the tip, which is truncate and not arcuate, as in the preceding species. Forceps as in *venusta*.

♀: genital segment a little shorter than the three preceding ventral segments together, laterally more compressed than in *venusta;* upper plate a little longer than the lower one, gradually tapering toward tip, which is straight and not so sharply pointed as in *venusta;* lower plate also simple.

Described from numerous specimens bred from closed mamma-like galls on leaves of *Celtis*.

Pachypsylla (Blastophysa) c.-gemma, new species.

Average length 3.5 mm. Glossy. Dark brown or lighter, head and thorax dirty brownish-yellow or deep gamboge-yellow, with greenish and often reddish tint; front wings uniformly yellowish-brown (lighter or darker); abdomen nearly black, sutures of the segments reddish, often the whole abdomen brownish-yellow. Head vertically inclined, as in the other species, with the eyes a little narrower than the widest part of the thorax; vertex shining, rugoso-punctate, yellowish-gray, twice as wide as long, not narrowing anteriorly, very slightly emarginate posteriorly, anterior margin straight, discoidal impressions large, foveiform, but shallow and ill-defined; median line fine; frontal cones vertical, somewhat variable in form, but usually subtransverse, always rounded at tip, more or less strongly divergent, rugoso-punctate, slightly hairy; antennæ fully as long as the width of the head, less stout than in the other species of the genus, yellow, more or less variegated and tipped with black; joints subturbinate, joint 4 not quite one-half as long as 3, the succeeding joints a little shorter than 4, but not decreasing in length, 9 and 10 closely united and together shorter than the preceding joint; terminal bristles very short; pronotum very short, of equal width, slightly emarginate behind, shining, impunctate; dorsulum formed as in other species, usually shining, finely alutaceous, with sparse transverse aciculate lines, which are sometimes absent; mesonotum formed as in other species, shining, very finely alutaceous; color of dorsulum and mesonotum very variable, usually brownish-yellow with greenish tinge, or yellowish-green with more or less indistinct markings of light brown; sometimes the color is more decidedly yellow, or even orange yellow, or nearly wholly pale green. Wings glossy, decidedly shorter and more leathery than in the other species, decidedly sub-convex, at basal third very slightly wider than at terminal third, transversely rugose, uniformly immaculate, costal margin at base strongly arched, then nearly straight, tip of wingly broadly rounded, inner margin regularly curved; venation much less prominent than in the genuine Pachypsyllas; pterostigma very indistinct; petiolus cubiti about half as long as the discoidal part of the subcosta, which is as long

as, or a little longer than, the basal portion; radius nearly straight, third and fourth furcals of nearly equal length, terminating very obliquely upon the margin, stem of second fork a little longer than third furcal, first furcal but little longer than the stem of the first fork and one-third shorter than the second furcal, which is but little longer than the fourth furcal; outer basal cell very large and nearly as long as the inner one; base of pterostigma nearer to the middle than to basal third of wing; first furcal terminating at about the middle; margin of first marginal cell as long as that of second; margin of cubital cell shorter. Abdomen in matured specimens dark gray, each segment bordered behind with roseate color, in immature specimens brown or brownish-yellow. Metasternal processes pale-green, elongate oval, obtusely rounded at tip. Femora usually brownish-yellow, sometimes blackish, with exception of the tip; tibiæ and tarsi black.

♂: genital segment somewhat longer than the preceding ventral segment; plate as high as the length of the segment, anterior margin straight, posterior lateral lobe very feebly indicated toward the tip, the plate, therefore, slightly wider at tip than at base, posterior edge slightly curved, tip truncate; the lobe is hairy, opaque, rugose, and divided from the main part of the plate by a longitudinal depression; forceps three-fourths as high as the plate, anterior edge slightly convex, posterior edge slightly concave, tip acute.

♀: genital segment somewhat longer in proportion to the rest of the abdomen than in *c.-mamma*, but otherwise not different.

Described from numerous specimens reared from a small, rounded, more or less irregular swelling of the bud of *Celtis*.

The species shows sufficient differences, as compared with the more typical Pachypsylla, to warrant separation into a sub-genus, which I would designate by the name of Blastophysa, and which in future, with increased material, will probably be accepted as a good genus.

The following dichotomic table gives the principal differences between the three species of Pachypsylla just described:

Head and dorsum opaque; front wings submembranaceous or subhyaline, not rugose; pterostigma distinct; both marginal cells very long, narrow, and of about equal size and length; anal style of full-grown larva and pupa long.

Dorsulum and mesonotum alutaceous, glabrous; front wings narrowly rounded at tip, widest in basal half; genital segment of female longer than the rest of the abdomen; anal style of full-grown larva and pupa notched at top ..... *venusta*.

Dorsulum and mesonotum rugoso-punctate, with distinct but very short, sparse pubescence; front wings broadly rounded at tip, widest in terminal half; genital segment of female shorter than the rest of the abdomen; anal style of full-grown larva and pupa pointed at tip ..... *c.-mamma*.

Head and dorsum shining, without pubescence; front wings somewhat convex, basal half not wider than terminal half, broadly rounded at tip, distinctly rugose; pterostigma indistinct; marginal cells less narrow, the first shorter and somewhat smaller than the second; genital segment of female shorter than the rest of the body; anal style of full-grown larva and pupa very short, nicked at tip ..... *c.-gemma*.

Sub-family TRIOZINÆ.

CEROPSYLLA, new genus

Body moderately slender, slightly convex longitudinally, glabrous, impunctate, opaque. Head with the eyes slightly narrower than the widest part of the thorax; vertex nearly half as long as wide, convex anteriorly, slightly emarginate behind; discoidal impressions large and polished, but shallow and ill-defined; frontal cones well separated from, and much depressed below, the plane of the vertex, nearly vertical, a little longer than wide, about half as long as the vertex, not divergent, not narrowing anteriorly, obtusely rounded at tip, jet black, opaque, slightly pubescent; antennæ more than twice as long as the width of the head, thin, terminal joints distinctly broader, joint 3 as long as 4 and 5 together, the last two joints less connate than usual, terminal bristle short. Thorax with the pronotum very short, deeply emarginate behind, lower than the head, and almost covered at the middle by the overlapping dorsulum; dorsulum longer than wide, anterior lobe much more developed than the posterior, laterally convex, gently ascending posteriorly; mesonotum nearly as long as dorsulum, of usual form.

Wings flat, perfectly hyaline, not sculptured, two and one-half times longer than wide, widest beyond the middle, outer costa gradually and slightly arched at base, tip distinctly angulated; basal part of subcosta unusually long, as long as the branch of the second fork; the stems of the two forks not starting from the same point of the subcosta, that of the first fork starting alone from the subcosta, some distance before the usual separation point of the principal veins; discoidal part of the subcosta extremely short—in fact, hardly perceptible; thus the radius, the radial part of subcosta and the stem of the second fork start from nearly the same point; radial part of subcosta but little shorter than the stem of first fork; radius straight, unusually short—shorter than the basal part of the subcosta; stem of second fork running, at basal fourth, very close to the radius, then gradually diverging from it; tip of wing within second marginal cell, but very close to the fourth furcal, which is nearly equal in length to the first and distinctly longer than the third furcal; second furcal nearly twice as long as the third and about as long as stem of the second fork. Basal cells very long, the outer not quite attaining the middle of the wing, the inner reaching beyond the middle; radial cell much shorter than outer basal cell; first marginal cell much larger than the second, but of similar shape.

Ceropsylla sideroxyli, new species.

Average length, 4.2 mm. To the characters given above in the generic description but little remains to be added. The color is greenish-yellow on the upper side, abdomen and under side more decidedly green; dorsal marking of brownish-yellow faintly indicated; antennæ black, with the three basal joints pale yellow; legs yellowish-green or pale yellow. The wings are perfectly colorless and transparent, the veins very fine, blackish. The exceptional arrangement of the venation, especially the almost complete absence of the discoidal part of the subcosta, produces some curious results, viz., the basal part of the subcosta and the radius appear to form a single straight line, and the discoidal cell is triangular, with the angle towards the base of the wings narrowly produced. The

radial part of the subcosta terminates nearly at the middle of outer costa, the radius terminating about half way between the end of the radial part of subcosta and the tip of the wing; the outer basal cell is about one-third longer than the radial cell and little shorter, but much narrower than the inner basal cell.

Described from fourteen specimens.

The secondary sexual parts in the specimens before me are not well preserved, owing to the immature condition of the specimens, and I prefer to leave them undescribed at present.

The form of the head and thorax, and, in fact, the general appearance of this genus, show no important or essential differences from the typical Triozas, but the wing-venation is without parallel in the family, and so remarkable that, with but a single specimen for examination, it might be considered a rather interesting monstrosity, such as can occasionally be observed in large series of specimens of other species. The specimens examined, however, show precisely the same venation, and this character, together with the singular form exhibited in the full-grown larva, necessitates the establishment of a new genus. The specimens before me were bred from the larva, and as they died shortly after acquiring wings, they are more or less immature.

Full-grown larvæ were found by Mr. Wittfeld at Georgiana, in Southern Florida, on the under side of the leaves of *Sideroxylon masticodendron*, imbedded in small scattered cup shaped excavations, which, on the upper side of the leaves, appear as rough, elevated pustules. A white, wax-like (not flocculent) excretion covers the dorsal surface of the larva, and has suggested the generic name.

RHINOPSYLLA, new genus.

Body moderately slender, very slightly convex dorsally, opaque, glabrous, impunctate. Head (including eyes) wider than the widest part of the thorax, obliquely prolonged and narrowing behind the large and convex eyes, which are thus widely distant from the pronotum; hind angles obtuse, hind margin nearly straight, and not quite half as wide as the widest part of the head. Vertex deeply and triangularly excised in the middle of the anterior margin, which is very oblique each side of the excision. The vertex thus appears to be separated anteriorly in two cones pointing obliquely forward, and this peculiar bi-rostrate appearance of the head is enhanced by the basal joints of the antennæ forming apparently the continuation of these cones; no trace of frontal cones; front margin of vertex with-

in the incisure not acute, but very narrowly rounded; anterior ocellus at the bottom of the incisure only visible from the front, but not readily perceptible; discoidal impressions very conspicuous, long, lineiform, reaching the hind margin of the head. Antennæ more than twice as long as the greatest width of the head; joints 1 and 2 longer than usual, joint 3 longer than 4 and 5 together, and at middle distinctly wider than the succeeding joints, but narrower than joint 2. Thorax, with the pronotum moderately short, slightly ascending posteriorly; front and hind margins but slightly curved, the latter, however, narrowly notched at middle; lateral impressions deep and large, situated at the hind margin; dorsulum distinctly wider than long, anterior lobe sub-acuminate in middle of front to fit in the emargination of the pronotum; mesonotum of usual form, subdepressed on the disc, convex at the sides, nearly as long as the dorsulum; metasternal processes small, elongate, pointed at tip. Front wings very long and narrow, more than three times longer than wide, widest at middle, tip distinctly angulated, with the angle more acute than usual, colorless and perfectly transparent, venation fine; basal portion of subcosta nearly as long as the stem of first fork and a little longer than the discoidal and radial portions of subcosta combined; radius straight and not parallel with stem of second fork; stem of second fork nearly twice as long as that of the first; tip of wing distinctly within second marginal cell; outer basal cell as long as radial cell, which is as long as, or little longer than, the margin of the discoidal cell. Anterior legs longer than the others, and with the femora laterally much compressed and curved inwardly.

The form and venation of the wings do not offer any differences from the Triozinæ, and more particularly from certain typical Triozas, while the absence of frontal cones, together with the form of the third antennal joint, seem to point to an affinity with Bactericera, Puton (a genus which is unknown to me in nature). The remarkable formation of the head, however, removes Rhinopsylla not only from the other genera of this sub-family, but from all Psyllidæ hitherto described. The formation of the anterior legs is also a character not otherwise occurring in the whole family; but this might be a sexual character, as the female is still unknown.

Rhinopsylla schwarzii, new species.

Length, 3 mm. Head and thorax dull brick-red, the latter above indistinctly marked with pale yellow; upper surface opaque, not pubescent, and without other sculpture than the usual very fine alutation. Abdomen greenish, femora red, tibiæ and tarsi pale yellow, the former blackish at base. Oblique post-ocular prolongation of the head nearly as long as the anterior portion of the head; anterior median excision of the vertex forming an almost equilateral triangle; the two lobes of the vertex formed by the notch are also triangular, and not more porrect than the front margin of the eyes, which are semi-globular and very prominent; discoidal impressions forming each side a longitudinal line reaching to near the

hind margin of the head, deeply impressed behind and becoming obsolete before reaching the anterior margin of vertex; basal joints of antennæ larger and wider than usual and reddish; joint 2 narrower and shorter than 1, joints 3–6 and the bases of 7 and 8 pale yellow, remaining joints black; joint 3, of the form described above, longer than joints 4 and 5 together; joints 6, 7, and 8 each a little longer than joint 4; 9 and 10 of usual shape, closely connate; terminal bristles long. Pronotum colored as the head, of nearly equal width, laterally less convex than usual, nearly horizontal longitudinally, moderately long, indentation at middle of hind margin acutely triangular; dorsulum with very faint traces of paler longitudinal markings, very little higher than the pronotum. Mesonotum nearly as long as the dorsulum, with two broad pale median bands, separated by a fine subimpressed dark-colored median line, sublateral yellow lines barely indicated. Front wings, of the form described above, colorless, except a slight brown shade alongside the marginal venules; veins fine, yellowish-brown; third furcal one-third shorter than the fourth, and nearly rectangular upon the margin, second furcal about one-third longer than the fourth, strongly arched, first furcal slightly shorter than the third, terminating obliquely upon the margin; outer basal cell much narrower than the inner and as long as the radial cell; inner basal cell attaining the middle of the margin, marginal cells unlike in form but about equal in size. The anterior legs, especially the femora, are much longer than the middle legs; the anterior femora are, moreover, much wider, flattened, and bent inwardly at middle, or rather sinuate at the inner broad side.* The hind legs are nearly as long as the anterior, but the femora are of normal form. Metasternal processes rather widely separated, conical, acuminate.

The genital armature of the male cannot properly be described from the two specimens before me.

Described from two ♂s, found March 11th, 1879, at Baldwin, Fla., by Mr. E. A. Schwarz, to whom I take pleasure in dedicating the species, on low plants in the cypress swamps, but the food-plant of the species still remains unknown.

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*This curving of the anterior femora is not equal in the two males before me, being very conspicuous in the one and less so in the other.

REMARKS ON THE BAG-WORM—THYRIDOPTERYX EPHEMERÆFORMIS.

By C. V. Riley.

(Read April 13, 1883.)

Having been asked by members of the Society quite frequently of late to explain the facts in relation to the common bag-worm, and as the facts are somewhat puzzling to the uninitiated, I have thought it of sufficient interest to state them.

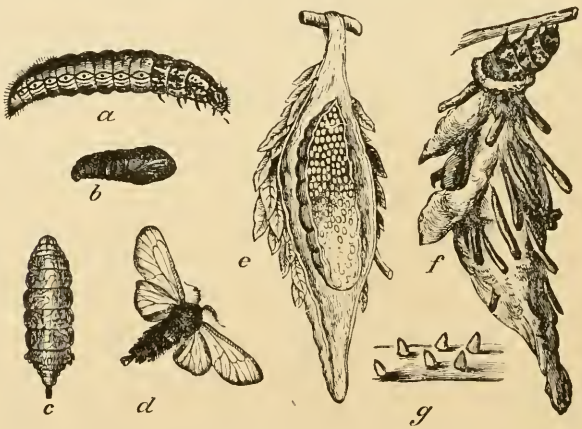

Fig. 1. Thyridopteryx ephemeræformis: *a*, larva; *b*, male chrysalis; *c*, female moth; *d*, male moth; *e*, follicle and puparium cut open to show eggs; *f*, full grown larva with bag; *g*, young larvæ with their conical upright coverings; all natural size.

The bags, as they hang from the trees at the present time, and as illustrated by these specimens which I now exhibit, will be found to consist of very strong silk, and, while a large proportion of them contain little or nothing, many of them have within a brown shell, known as the puparium, and containing a large number of soft, yellowish eggs, interspersed with fulvous down. In a few days these eggs will hatch, the young worms from them will crawl out of the bags and disperse over the tree, covering themselves with

little conical silken coats, to the outside of which they attach bits of leaves and twigs. These bags are at first held upright (Fig. 1, *g*), but, with increase in size, they are allowed to hang (Fig. 1, *f*). In the autumn, after attaining full growth, the worms appear as in Fig. 1, *a*. They now fasten the bags to the permanent parts of the tree, and transform to the pupa state. In due time, the male pupa (Fig. 1, *b*) pushes down toward the anal orifice, and a little, black, glassy-winged moth (Fig. 1, *d*), with strongly pectinate antennæ, escapes.

The female (Fig. 1, *c*) only partly issues from her pupa shell, receives the male, and retreats into the puparium, in which she deposits her eggs.

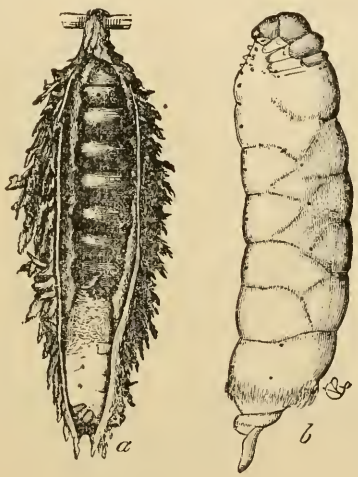

FIG. 2. THYRIDOPTERYX EPHEMERÆFORMIS: *a*, follicle cut open to show the manner in which the female works from her puparium and reaches the end of the bag, natural size; *b*, female extracted from her case, enlarged.

In reference to the act of coition, which has not been fully understood by entomologists, I quote from a former article of mine: *

"We have seen that, by means of the partial elongation of her puparium and her partial extraction therefrom, the female is able

* *Sci. Am.*, Suppl., April 3d, 1878.

to reach with her head to the extreme lower end of her follicle, causing, in doing so, the narrow elastic portion of the follicle to bulge, and the orifice to open more or less, as it repeatedly did while the larva was yet feeding, whenever the excrement had to be expelled. Fig. 2, *a*, shows a follicle cut open so as to exhibit the elongated puparium, and the female extended from it as she awaits the male; *b*, represents this degraded female more in detail. A cursory examination of the male shows the genital armature, which is always exposed, to consist of (1) a brown, horny, bilobed piece, broadening about the middle, narrowing to and notched at tip, concave, and furnished with a tuft of dark hairs at tip inside; (2,) a rigid brown sheath, upon which play (3) the genital hooks or clasps, which are also concave inside, strongly bifid at tip, the inner finger furnished with hairs, the outer produced to an obtuse angle near tip, and generally unarmed, (Fig. 3, *e*). In repose, this

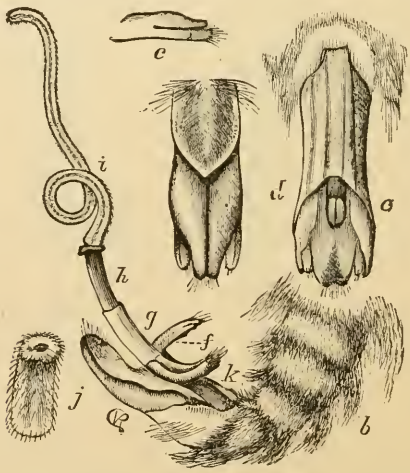

FIG. 3. THYRIDOPTERYX EPHEMERÆFORMIS: *b*, the end of male abdomen from the side, showing genitalia extended; *c*, genitalia in repose, ventral view; *d*, do., dorsal view; *e*, tip of bifid clasp; *j*, tip of penis; all enlarged.

armature appears as in Fig. 3, *c*, from beneath, and as at *d*, from above, and is well adapted to prying into the opening of the follicle. The male abdomen is telescopically extensile, while the tip easily bends or curves in any direction, but most naturally beneath, as at *b*, where it is represented enlarged about six times, and with

all the genital parts expanded; *k*, the fixed outer sheath; *f*, the clasps; *g*, a pale membranous sheath, upon which the præputium (*h*) plays, as on the finger of a glove; *i*, the fleshy elastic penis, armed with retorse hairs, and capable of extending to nearly one-fourth of an inch; *j*, showing the end still more fully enlarged. With this exposition of details, not easily observed or generally understood, the act of fecundation is no longer a mystery.

"Experiments made in 1878 led me to conclude that parthenogenesis, although not improbable, seldom occurred in this species. In some sixty instances where I excluded the males, the females either worked out of their follicles and dropped to the ground without ovipositing, or else died and dried up in the ends of the same, likewise without laying. I have found the same to hold true in those exceptional cases (four have already come under my notice) where, in a state of nature out of doors, the larva had undergone its transformations head upward. In every instance the poor female had worked out of the puparium and butted against the closed end of the follicle, perishing finally without laying, because the male could not reach her.*

"The impregnated female that has laid her eggs always works out of her follicle when her task is completed, and drops to the ground exhausted; but she may at once be distinguished from those which perish without ovipositing by her shrunken, eggless body.

"The fawn-colored down, which the female intermingles with her eggs, is composed of the silky hair rubbed from her body. If examined while yet in the puparium, and just before she would naturally issue therefrom, each ring of the body of the female is seen to be more or less clothed with this silky material, while the eggs are perfectly free from it until they are laid. Under the microscope, this covering is seen to consist of the most delicate fibres, many times finer than ordinary silk, and it is so easily detached that most of it rubs off and remains in the puparium on the partial issuing therefrom of the female."

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* Since this was written more elaborate experiments have fully determined that parthenogenesis does occasionally occur in the species.

LIST OF PLANTS ADDED TO THE FLORA OF WASHINGTON FROM APRIL 1, 1882, TO APRIL 1, 1884.

By Lester F. Ward.

(Read November 24, 1882.)

[This list is supplemental to Ward's "Guide to the Flora of Washington and Vicinity" (Bulletin, U. S. National Museum). Unless otherwise stated, the species enumerated were found by the author.]

40*a*. **Argemone Mexicana**, L. Prickly Poppy.

Above Georgetown, near the ice house. Dr. E. Foreman, June 17, 1883.

89*a*. **Viola canina**, L., var. **sylvestris**, Regel. Dog Violet.

Left bank of Rock Creek below Pierce's Mill. First found and reported by Mr. Horace B. Patton, in April, 1883. Collected by myself May 5, 1883.

93*a*. **Viola tricolor**, L. Pansy. Heart's-ease.

Reform School region, escaped and much reduced in size. June 25, 1882.

124*a*. **Scleranthus annuus**, L. Knawel.

Easby's Point. Theo. F. Streets, May 18, 1883.

142*a*. **Hibiscus Syriacus**, L. Shrubby Althæa.

Escaped in many places.

142*b*. **Hibiscus esculentus**, L. Okra. Gumbo.

Pierce's Mill road, near Tenallytown, Oct. 22, 1882.

208*a*. **Desmodium ochroleucum**, M. A. Curtis.

Mount Hamilton,* Dr. E. Foreman, Sept. 24, 1882. Should be collected before the middle of September.

234*a*. **Phaseolus diversifolius**, Pers. Wild Bean.

Alexandria branch, B. & O. Railroad, above Uniontown, Sept. 10, 1882. Also by Dr. Foreman near Roache's Run, Va.

304*a*. **Callitriche Austini**, Eng.

North of Mount Hamilton. June 24, 1882.

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* The conspicuous hill opposite Mt. Olivet Cemetery, otherwise known as "Mulligan Hill" and "Munger's Hill," is thus designated on Boschke's "Topographical Map of the District of Columbia," 1880.

331*a*. **Conium maculatum**, L. Poison Hemlock.

Rhode Island avenue, on a vacant lot near 17th street. June 17, 1883.

333*a*. **Cicuta bulbifera**, L. Water Hemlock.

Alexandria Canal, opposite the Arlington estate. Dr. E. Foreman, 1882.

391*a*. **Eupatorium altissimum**, L.

Between the canal and the river, a short distance below Chain Bridge. First reported by Dr. Vasey and Dr. Chas. Mohr at the end of September, 1882. Collected there by myself Oct. 5, 1882.

436*a*. **Aster ericoides**, L., var. **villosus**, Gray.

Woodley Park, Sept. 17, 1882.

457*a*. **Pluchea camphorata**, DC. Salt-Marsh Fleabane.

Marshall Hall, Md. Collected by Mr. O. M. Bryan in 1883; specimens sent to Dr. Foreman, and by him shown to me.

497*a*. **Galinsoga parviflora**, Cav.

Fourteenth street near G, July 25, 1882. First seen by Dr. Chas. Mohr. Since observed by myself on Sixteenth street.

502*a*. **Leucanthemum Parthenium**, Godron. Feverfew.

Park near B and Sixth streets. July 10, 1884. Canal road above Georgetown, June 17, 1883.

504*a*. **Senecio vulgaris**, L. Common Groundsel.

Alexandria branch, B. & O. Railroad, a short distance above Uniontown, May 27, 1883.

536*a*. **Tragopogon porrifolius**, L. Common Salsify. Oyster-Plant.

Nearly the same locality as the preceding. Dr. Foreman, May, 1883.

543*a*. **Campanula aparinoides**, Pursh. Marsh Bellflower.

Rock Creek. Mr. M. S. Bebb, 1863.

In preparing the "Flora," several species were admitted, which, though not yet seen by the author or any of the recent collectors, were yet vouched for by perfectly competent authorities who had themselves found them in earlier years. In harmony with the rule thus adopted, I now add, without hesitation, this species which Mr. Bebb informs me, in a letter, that he was in the habit of collecting in whilom days. From his description of the locality, I infer that the spot on which the plant grew is now under cultivation.

628*a*. **Lycopsis arvensis**, L. Small Bugloss.

Near the Outlet Lock, Dr. Foreman, 1882. Collected there by myself June 17, 1883.

629*a*. **Heliotropium Europæum**, L. HELIOTROPE.

Georgetown, near the Aqueduct Bridge, Mr. M. S. Bebb, 1863.

The above remarks on *Campanula aparinoides* apply equally to this species.

640*a*. **Cuscuta compacta**, Juss. DODDER.

Specimen found in the herbarium of the Department of Agriculture, collected near Washington by Dr. Vasey.

661*a*. **Gratiola aurea**, Muhl.

Specimen in my herbarium (wrongly labeled) collected on the Eastern Branch marsh, in 1873.

732*a*. **Scutellaria parvula**, Michx. SCULLCAP.

This species was simply overlooked in the catalogue. I have specimens collected by Prof. Chickering near the Insane Asylum, May 26, 1875.

738*a*. **Lamium purpureum**, L. DEAD-NETTLE.

Soldiers' Home grounds. I have fine specimens of this species which I collected in this locality July 20, 1873, but had overlooked in preparing the catalogue. The omission was observed by Mr. Patton, who still found it there in 1882, and I again met with it widely spreading through the grounds on May 20, 1883.

746*a*. **Plantago pusilla**, Nutt.

Near the southwest corner of the Soldiers' Home grounds (outside), May 20, 1883.

773*a*. **Polygonum tenue**, Michx.

Mount Hamilton, Dr. E. Foreman, Sept. 24, 1882. Collected by myself on both sides of the hill, Oct. 1, 1882.

797*a*. **Euphorbia mercurialina**, Michx.

In a communication dated Dec. 6, 1882, the late Dr. George Engelmann informed me that this species was once sent to him labeled Washington, D. C., by Mr. F. Pech, who collected here extensively.

884*a*. **Zannichellia palustris**, L.

In the canal, above Foundry Run, June 17, 1883.

986*a*. **Eriocaulon septangulare**, With.

Eastern Branch (between tides) above Uniontown, Sept. 10, 1882. Abundant in the Potomac below Analostan Island, and near Custis Spring.

986*b*. **Cyperus flavescens**, L.
Specimen found in herb. Dep't Agriculture, collected in 1872 by Mr. Rudolph Oldberg, in the vicinity of Washington.

990*a*. **Cyperus inflexus**, Muhl.
Chain Bridge, Dr. Chas. Mohr, September, 1882.

996*a*. **Cyperus refractus**, Eng.
Collected near Washington by Dr. George Vasey.

1002*a*. **Eleocharis Engelmanni**, Steud.
Dried pond above Sandy Landing, June 24, 1883.

1019*a*. **Rhynchospora fusca**, Roem. & Schult.
Specimens in herb. Department of Agriculture, collected in the vicinity of Washington by Dr. George Vasey.

1031*a*. **Carex muricata**, L.
Established in and around the Agricultural Department grounds, *fide* Dr. Vasey and Mr. Conant.

1128*a*. **Glyceria pallida**, Trin.
North side of Four Mile Run pond, Dr. Vasey, 1883.

1160*a*. **Hordeum jubatum**, L. SQUIRREL-TAIL GRASS.
Park near B and 4½ streets, July 10, 1882.

1169*a*. **Arrhenatherum avenaceum**, Beauv. OAT GRASS.
Hillside above Boundary street and Conn. Ave., June 17, 1882.

1195*a*. **Setaria Italica**, Kunth. MILLET, BENGAL GRASS.
Agricultural Department grounds, July 22, 1882.

1253*a*. **Isoetes Engelmanni**, Al. Br., var. **valida**, Eng. QUILLWORT.
Pool among rocks above Sandy Landing, June 11, 1882.

CORRECTIONS.

The following names should be substituted for those standing in the Check-list opposite these numbers:

236. **Rhynchosia tomentosa**, Hook. & Arn., var. **erecta**, Torr. & Gray.

989. **Cyperus microdontus**, Torr.

991. **Cyperus vegetus**, Willd.

1055. **Carex glaucodea**, Tuckerm.

1129. **Glyceria Canadensis**, Trin.

DESCRIPTION OF A NEW GENUS AND SPECIES OF PEDICULATE FISHES (HALIEUTELLA LAPPA).

By G. Brown Goode and Tarleton H. Bean.

(Read March 8, 1884.)

HALIEUTELLA, new genus.

Body maltheiform, subcircular, depressed, its width equal to its length; covered with flaccid, inflatable skin. Spines feeble and less numerous than in *Halieutæa*. Head merged in body; forehead with a transverse bony ridge; no perceptible supraoral cavity; no tentacle. Mouth small, terminal; lower jaw slightly curved forward. Teeth in the jaws minute, cardiform; not discernible on palate, though possibly present. Carpus broad, slightly exserted. Pectoral fins remote from tail, obliquely placed, with membranes subvertical. Branchial aperture posterior to carpus, upon the disk, and not remote from its margin. Dorsal fin 5-rayed, inserted at junction of disk with caudal peduncle. Anal fin 4-rayed, originating at root of caudal peduncle.

Halieutella lappa, new species.

Disk subcircular, more than two-thirds as long as the body. Body covered with a loose, flaccid, inflatable skin, which so obscures its proportions that it is impossible to determine its exact height, but it is not nearly so much depressed as in the related genera. When the body is inflated the height and length of the disk are nearly equal.

Spines rather feeble; about ten between snout and dorsal fin. About six strong spines, with conical bases and stellular tips on the outer margin of the disk on each side, the anterior of them being opposite the eye. In front of these spines on the discal margin, and between them and the snout, are several small, simple spines, pointing backward. Belly armed with spines similar to those on the back, but weaker. A stellate spine upon the tip of the snout, with two weaker, simple spines on each side. Nasal openings midway between eye and tip of snout. Mouth small, upon the margin of the disk. The upper jaw is shorter than the diameter of the eye. Teeth as described in the generic diagnosis. Dorsal fin inserted at posterior limit of disk, with five simple, articulated rays, its longest ray one-fifth as long as the disk. Anal fin with four simple, articulated rays, inserted directly beneath the fourth ray of the dorsal; its second, and longest, ray one-fourth as long as the disk. Caudal twice as long as anal and slightly longer than caudal peduncle, with nine simple, articulated rays. Carpus inserted at a distance from the snout equal to twice the length of the longest pectoral ray, which is slightly greater than the distance of posterior margin of carpus, at its junction with disk, from vent. Number of pectoral rays, 15. Ventral inserted at a point equidistant from the snout and the origin of the anal; length of its longest ray (the fourth) equal to one-half the distance of the anal fin from the snout. Number of ventral rays, 5. D. 5; A. 4; C. 9; P. 15; V. 5.

A single specimen, 1¼ inches long, was dredged by the U. S. Fish Commission steamer Fish Hawk at station 1151, north latitude 39° 58′ 30″, west longitude 70° 37′, in a depth of 125 fathoms. Color, yellowish white.

DESCRIPTIONS OF SOME NEW NORTH AMERICAN BIRDS.

By Robert Ridgway.

Read February 23, 1884, and published by permission of the Director of the U. S. National Museum.

1. Parus atricapillus turneri, new subspecies.

Subspecific Characters.—Similar to *P atricapillus septentrionalis*, but still lighter in color, the gray of the upper parts very slightly, or not at all, tinged with brownish, the sides and flanks with little or no buff tinge.

♂: Wing, 2.70; tail, 2.65–2.90; tarsus, .65–.70. ♀: Wing, 2.55; tail, 2.55. *Hab.* Alaska.

Type, No. 70,826, (in collection, U. S. National Museum,) St. Michael's, Alaska, May 1, 1876; L. M. Turner.

2. Psaltriparus minimus californicus, new subspecies

Subspecific Characters.—Differing from true *P. minimus* in much lighter colors, especially on the lower parts, which are very pale brownish gray, or soiled brownish white, only slightly tinged purplish brown on the flanks. *Hab.* California, except northern coast district.

In "Birds of North America," (page 397), Professor Baird remarks that "there is quite an appreciable difference between specimens of this species from Washington Territory and California; the latter are smaller, the under parts paler." He did not separate them, however, the scant material at his command evidently not warranting such a procedure. With numerous additional specimens, the differences are none the less striking, and, in my opinion, fully sufficient to justify their separation as well-defined geographical races.

It may be remarked that specimens from Marin County, just north of the Bay of San Francisco, are dark colored above like typical

P. minimus, but are light colored beneath as in *californicus*, being thus, as should be expected, intermediate; further north, along the humid, densely wooded coast, specimens probably approximate more closely to the typical form.

Types, Nos. 91,643, ♂ ad., Baird, Shasta Co., California, May 27, 1883, Chas. W. Townsend; 71,935, ♀ ad., Ft. Tejon, Cal., Aug. 7, 1875, H. W. Henshaw; 71,924, Walker's Basin, Cal., fall; 71,918, ♀ ad., same locality and collector, Nov. 10, 1875; 91,890, juv., Baird, Shasta Co., California, June 26, 1883, Chas. W. Townsend.

3. Colaptes mexicanus saturatior, new subspecies.

Subspecific Characters.—Similar to *C. mexicanus*, but much darker colored. Back, etc., rich, dark umber-brown, throat deep plumbeous-gray, and lower parts deep vinaceous-pink. *Hab.* Northwest coast, from the Columbia River to Sitka.

Types, Nos. 40,063, ♂ ad., Neah Bay, Washington Territory, J. G. Swan; 13,516, ♀ ad., Simiahmoo, Washington Territory, Dr. C. B. Kennerly.

4. Myiarchus mexicanus magister, new subspecies.

Subspecific Characters.—Differing from typical *M. mexicanus* in much larger size, with proportionally longer and stronger bill. Wing, 4.05–4.40; tail, 4.10–4.60; culmen, 1.10–1.27; bill from nostril, .60–.82 (average about .70); tarsus, .88–.95 (average about .92). *Hab.* Western Mexico, north to southern Arizona.

Types, Nos. 86,005, ♂ ad., Camp Lowell, Arizona, and 57.640, ♀ ad., Tehuantepec, Mexico.

In order to determine positively, if possible, the relationship of the larger Mexican *Myiarchi*, I sent recently to Dr. Sclater a series of specimens, asking him to compare them with Kaup's types of his *Tyrannula mexicana* and *T. cooperi*, which were supposed to be in the British Museum. His reply has just been received, and is, in substance, as follows:

"The original of Kaup's description [of *T. mexicana*] is not in

the British Museum, ... but in that of Darmstadt, whence I obtained the loan of it in 1871. I cannot do this again, but I have a specimen in my own collection which, on that occasion, I compared with Kaup's type and found to be similar, except as regards the abraded plumage of my specimen. This specimen certainly agrees best with the smaller or eastern race, ... that is with *M. cooperi* of Baird, ... but is smaller in dimensions than Baird's type, and, therefore, much smaller than the large western form of the same species. . . . . What *Tyrannula cooperi* of Kaup was, it is now, as I believe, impossible to ascertain; because, if the specimen so described is in the British Museum, as Kaup affirms, it is not marked, and is, consequently, unrecognizable."

It will thus be seen that the large western race is unnamed, which is my excuse for providing it with a name as above.

5. Myiarchus lawrencei olivascens, new subspecies.

Subspecific Characters.—Differing from true *M. lawrencei* of Eastern Mexico, in very much paler colors: Pileum light hair-brown, instead of dark sooty brown; back light grayish olive, instead of dark brownish olive; remiges and rectrices edged with dull ochraceous-rufous, instead of rusty rufous. Wing, 2.90–3.25; tail, 3.00–3.25; culmen, .65–.70; width of bill at base, .30–.35; tarsus, .70–.75. *Hab.* Western Mexico, north to southern Arizona; in winter, western and southern Mexico, and Yucatan.

Type, No. 57,655, ♂ ad., Sta. Efigenia, Tehuantepec, Dec. 25, 1868; F. Sumichrast.

I have carefully examined the type of *Musicapa lawrencii* Giraud, and find that it corresponds exactly with specimens from eastern Mexico, which are, without exception, (so far as the National Museum series are concerned,) much darker colored than those from western Mexico.

In Hist. N. Am. B. (ii, p. 333), *M. lawrencei olivascens* was erroneously considered to be the true *M. lawrencei*, the dark eastern race (true *M. lawrencei*) being referred to *M. nigricapillus* Caban. The latter is similar, but still darker, having the pileum nearly black, (whence the name). It reaches its extreme develop-

ment in Costa Rica, but extends northward to Guatemala, whence northward it gradually passes into *M. lawrencei*. I have not seen Arizona examples, but would have no hesitation in referring them to *olivascens* on geographical grounds alone. That I am correct in doing so is strongly indicated by the following quotation from Mr. Brewster's remarks upon nine specimens obtained in the Santa Rita Mountains, in southern Arizona, by Mr. F. Stephens. (*Cf.* Bull. Nutt. Orn. Club, vii, Oct., 1882, p. 205): "These show little variation in color or markings, but the females are slightly smaller than the males. The characters which separate *M. lawrencii* from its respective allies, *M. tristis*, of Jamaica, and *M. nigricapillus*, of Central America, are well maintained in this series." [*Cf.* Hist. N. Am. B., ii, p. 333.]

In this connection it may be well to give a brief review of the Mexican *Myiarchi*, from the writer's standpoint, a special study of the subject, based upon the extensive series in the National Museum collection, (including many types,) enabling him to feel pretty sure as to the limits of the respective species.

In the National Museum we have the following:

1. *M. crinitus* (LINN.), CAB., as a migrant through eastern Mexico.

2. *M. mexicanus* (KAUP) LAWR.: *a. mexicanus*, from eastern Mexico, north to the lower Rio Grande Valley, in Texas; *b. magister*, NOBIS, from western and southwestern Mexico, and north to southern Arizona.

3. *M. nuttingi* RIDGW., from southwestern Mexico. (*Cf.* Proc. U. S. Nat. Mus., vol. 5, pp. 394, 395.)

4. *M. yucatanensis* LAWR. from Merida, Yucatan. (This seems to me to be most nearly related to the Antillean species (*M. stolidus*, etc). I have carefully examined the type, which is in the National Museum collection, and cannot at all agree to its reference to *M. mexicanus*.)

5. *M. lawrencei* (GIRAUD) BAIRD: *a. lawrencei*, from eastern

Mexico (north to southern Texas?); *b. olivascens*, NOBIS, from western Mexico, (southern Mexico, and even Yucatan in winter,) and north to southern Arizona.

6. *M. flammulatus* LAWR., from southwestern Mexico (Tehuantepec to Mazatlan). Several examples of this widely distinct species are in the National Museum collection.

6. Pediœcetes phasianellus campestris, new subspecies.

PRAIRIE SHARP-TAILED GROUSE.

SUBSPECIFIC CHARACTERS.—Differing from *P. phasianellus columbianus* in rather lighter and much more ochraceous coloration above, with the black bars narrower and less regular, and in having the V-shaped markings of the lower parts much less distinct (never deep black).

Types, Nos. 76,743, ♂ ad., Illinois, and 19,173, ♀ ad., Rosebud Creek, Montana Terr.

In the Bulletin of the Nuttall Ornithological Club for October, 1882, p. 233, Mr. Brewster alludes to differences between specimens of the Sharp-tailed Grouse from Fort Walla Walla, Washington Terr., and others from eastern localities, but concludes that the differences noted "probably have only a local significance." This was formerly my opinion also; but many additional specimens subsequently received at the National Museum show conclusively that two very different styles of this bird inhabit the regions west and east of the Rocky Mountains, respectively. *P. phasianellus columbianus* is represented in the collection by specimens from Washington Territory, Oregon, Northern California, and Nevada, and *P. phasianellus campestris* by examples from Montana (east of the mountains), Eastern Wyoming and Colorado, Nebraska, Dakota, and Illinois.

P phasianellus campestris is the form described and figured by Audubon, (B. Am., v, p. 112, pl. 298,) under the name *Tetrao phasianellus*.

7. Lophortyx californicus brunnescens, new subspecies.

BROWN-BACKED VALLEY QUAIL.

SUBSPECIFIC CHARACTERS.—Differing from true *L. californicus* in much darker coloration, the upper parts being deep olive-brown (almost clove-brown) instead of grayish olive, the stripes along inner edge of tertial deep ochraceous instead of pale buff, and the elongated feathers of the sides deep olive-brown instead of grayish olive. *Hab.* Pacific coast, from San Francisco Bay north to Washington Territory.

South of San Francisco, this strongly-marked race appears to be replaced by the typical *L californicus;* at least, specimens in the National Museum collection from San José and Sta. Barbara are of the paler form. It is true that Audubon describes and figures the dark race, and says that the male, from which his description and figure of that sex are taken, was "procured on the 6th of March, 1837, near Santa Barbara," but it is well known that the localities ascribed to Townsend's specimens were, in many cases, erroneous; and, since he made collections near the mouth of the Columbia River, it is very likely that the specimen in question came from the latter locality.

It is possible that this race may have already been named, since there are some points in the *Ortyx douglassi* Vigors, (Zool. Jour., iv, 1829, 354; Zool. Voy. Blossom, 1839, 27, pl. 11,) which strongly suggest the female or full-grown young. There are, however, so many features, both in the description and figure, which cannot be reconciled with the present bird that their actual identity is, to say the least, very doubtful.

Types, Nos. 2,829, ♂, "Santa Barbara, California," and 2,830, ♀, locality unknown; both types of Audubon's description and plate of "*Ortix californica.*"

8. Phalacrocorax dilophus albociliatus, new subspecies.

LESSER WHITE-CRESTED CORMORANT.

Phalacrocorax dilophus albociliatus RIDGW., Cat. Aquat. and Fish-eating Birds, 1883, p. 27; no description.

SUBSPECIFIC CHARACTERS.—Similar to *P. dilophus floridanus*, but with the nuptial plumes pure white, instead of black. Similar in coloration to *P. dilophus cincinnatus*, but much smaller. *Hab.* Pacific coast of United States, from California (Farallone Islands) to Cape St. Lucas; Revillegigedo Islands, Western Mexico.

This is the small southern form of *cincinnatus*, being, like the latter, distinguished by its white nuptial tufts, but differs in its much smaller size, in which respect it agrees closely with *floridanus*. *P. dilophus* thus may be separated into four races, the two southern ones (*floridanus* and *albociliatus*) distinguished from their northern representatives (*dilophus* and *cincinnatus*) by smaller size alone, while the western forms (*cincinnatus* and *albociliatus*) appear to differ from the eastern ones only in the color of the nuptial tufts, which seem to be always white or much mixed with white, instead of black with little or no admixture of white.

DESCRIPTION OF A NEW AMERICAN KINGFISHER.

BY ROBERT RIDGWAY.

Read February 23, 1884, and published by permission of the Director of the U. S. National Museum.

Ceryle superciliosa stictoptera, new subspecies.

? *Chloroceryle superciliosa* SCL., P. Z. S., 1864, 176, (City of Mexico.)

Ceryle superciliosa LAWR., Ann. Lyc., N. Y., ix, 1869, 204, (Sisal, Yucatan).—(?) Id., Bull. U. S. Nat. Mus. No. 4, 1876, 3, (Isth. Tehuantepec).—(?) SUMICH., Mem. Bost. Soc., i, 1869, 560, (hot reg. of Vera Cruz).—(?) BOUC., Liste Ois. réc. Guat. (in Ann. Soc. Linn. Lyon), 1878, 26.

HABITAT.—Yucatan; also, presumably, other parts of Southern Mexico and Guatemala. (NOTE.—The references given above, which are preceded by a mark of interrogation, are so designated for the reason that specimens from the localities indicated have not been examined.)

SUBSPECIFIC CHARACTERS.—Similar to *C. superciliosa*, but outer webs of secondaries conspicuously spotted with white (in three transverse rows), and with the white on the rectrices much more extended.

Of *C. superciliosa* (*vera*), the Museum possesses specimens from Demerara, Trinidad, Isthmus of Panama, and Costa Rica. These all have the outer webs of the secondaries either entirely immaculate, or else marked with very minute specks of dull fulvous. These markings are wanting in the two Demerara examples, are barely indicated in two from the isthmus, and are rather distinct (though still deep fulvous in color) in the one from Costa Rica—rendering it, therefore, probable that specimens from intermediate points might complete the transition from one to the other. It should be remarked, however, that the Costa Rican example (No. 64,666) is much more like South American skins than those from Yucatan, upon which the new race (possibly species) is based.

Types, Nos. 39,297, ♂, and 39,206, ♀, Sisal, Yucatan, May, 1865; Dr. A. Schott.

NOTE ON PSALTRIPARUS GRINDÆ, BELDING.

By Robert Ridgway.

(Read February 23, 1884.)

In my description of this species, on p. 155, vol. 6, of the Proceedings of the United States National Museum, I inadvertently made an erroneous comparison between this species and *P. melanotis*, as follows: "From the latter [*P. plumbeus*] it differs in much whiter throat and decidedly clearer, more bluish, shade of the upper parts, in both of which respects there is a close resemblance to *P. melanotis*." I wrote from memory, not having a specimen of *P. melanotis* before me at the time. Upon actual comparison I now find that while the statement is essentially correct so far as the coloration of the lower parts is concerned, I was greatly in error regarding the coloration of the upper parts. The difference is very great, *P. melanotis* having the pileum and nape fine light plumbeous-gray, exactly like the back of *P. grindæ*, while the back, etc., are bright brownish drab, much like the pileum and nape of *P. grindæ*, only more olivaceous. The relative position of the two colors is, in fact, exactly reversed in the two species.

NOTE ON THE GENERIC NAME CALODROMAS.

By Robert Ridgway.

(Read February 23, 1884.)

In 1873 ("Nomenclator Avium Neotropicalium," p. 156), Messrs. Sclater and Salvin proposed the name *Calodromas* for *Eudromia elegans*, Lafr. & D'Orb. This name, however, is preoccupied, having been given to a genus of Coleoptera by Goudot, in 1832 (Rev. et Mag. de Zool.) I therefore propose as a substitute *Calopezus* (*καλός* = *pulcher*, *πεζός* = *pedestris*.)

DIAGNOSES OF NEW SPECIES OF BIRDS FROM KAMTSCHATKA AND THE COMMANDER ISLANDS.

By Leonhard Stejneger.

Read February 23, 1884, and published by permission of the Director of the U. S. National Museum.

1. Pica camtschatica, new species.

Diagnosis.—Larger than *P. caudata* and with longer bill; inner webs of the longest primaries white to the extreme tip; feathers of the throat black to the base.

♂ ♂: Total length, 525 mm.; wing, 218 mm.; tail f., 279 mm.; expos. culmen, 35 mm.

Hab.—Kamtschatka.

Types.—Nos. 89,144; 92,695, and 92,698, U. S. Nat. Mus.

2. Corvus grebnitskii, new species.

Diagnosis.—Nearly allied to *Corvus corax*, from which it differs in having the fourth and fifth primaries longest, and the latter decidedly longer than the second.

♂: Total length, 715 mm.; wing, 460 mm.; tail f., 255 mm.

♀: Total length. 660 mm.; wing, 426 mm.; tail f., 235 mm.

Hab.—Commander Islands, Bering Sea.

Types.—Nos. 92,759 and 92,760, U. S. Nat. Mus.

3. Alauda blakistoni, new species.

DIAGNOSIS.—Like *Alauda japonica* in the rusty tinge and the dark blackish brown scapulars and interscapulars, but differing in being larger and having a stronger and larger bill. The hind neck rusty colored, only dotted with small dark spots, forming a light collar between the strongly marked pileum and the dark color of the upper back.

♂ ♂: Total length, 187 mm.; wing, 116 mm.; tail f., 72 mm.; exp. culm., 13 mm.

♀ ♀: Total length, 186 mm.; wing, 109 mm.; tail f., 70 mm.; exp. culm., 12 mm.

HAB.—Kamtschatka and Bering Island.

TYPES.—Nos. 92,658 and 92,660, U. S. Nat. Mus.

4. Dendrocopos immaculatus, new species.

DIAGNOSIS.—Similar to *D. pipra*, but with unspotted white under tail-coverts, and the outer rectrices pure white, without dark cross-bars, or only with trace of a single bar; white bars on the wing broader; malar stripe narrow, broken, dusky, but not black.

♂: Total length, 167 mm.; wing, 97 mm.; tail f., 61 mm.; exp. culm., 18 mm.

HAB.—Kamtschatka.

TYPE.—No. 92,700, U. S. Nat. Mus.

REMARKS.—This is *Picus kamtschatkensis* of TACZANOWSKI (1882), but not of BONAPARTE (1854), whose type specimen came from Okotsk, *and not from Kamtschatka* BONAPARTE'S bird is, in every respect, a typical *D. pipra* and the name *P. kamtschatkensis* consequently an unconditional synonym of the Siberian form.

5. Lagopus ridgwayi, new species.

DIAGNOSIS: ♂ ♂, in summer-plumage, above brownish black with dark ferruginous brown cross-bars and mottlings, but without any trace of white, whitish, and grayish edgings or barrings; first summer-plumage with blackish jugulum as in *L. muta*; bill longer

and stouter than in the latter form; abdomen blackish in the perfect summer-plumage.

♂ ♂: Total length, 382–411; wing, 187–201; tail f., 102–112; bill from nostr., 10–12 mm.

♀ ♀: Total length, 357–384; wing, 179–189; tail f., 89–110; bill from nostr., 9.3–10.5 mm.

Hab.—Commander Islands.

Types.—U. S. Nat. Mus., Nos. 89,059; 89,062; 92,716; 92,709; 89,057; 92,712.

DIAGNOSES OF THREE NEW SPECIES OF FISHES FROM THE GULF OF MEXICO.

By Tarleton H. Bean, M. D., and H. G. Dresel, Ensign, U. S. N.

Read February 23, 1884, and published by permission of the Director of the U. S. National Museum.

The writers are preparing descriptions of all the fishes of the Gulf of Mexico represented in the collections of the United States National Museum, to form a bulletin of the Museum. As considerable time must elapse before the material can be ready for the press, they present here brief diagnoses of some of the new species in advance of the complete publication.

Siphostoma crinigerum, new species.

The types of this species are two males, No. 33,173, taken at Pensacola, by Jordan and Stearns. The species is closely related to *S. crinitus* (Jenyns), a species inhabiting the coast of Northern Patagonia.

The snout is very short, less than ⅓ length of head. Eye, 5 times in length of head. Head nearly 11 times in total length to caudal base. Height of body, half length of head. Length of marsupium is 4 times in the total to caudal base. Dorsal of 16 or 17 rays. Body rings 15; caudal rings 38 or 39. Dorsal fin above the first 3½ to 4 caudal rings. The marsupium occupies 17 caudal

rings. Minute filaments above the eyes, and apparently along the sides of the body.

Phycis floridanus, new species.

The type of the species is No. 32,762, taken by Silas Stearns at Pensacola. It is about 7¼ inches long. In general appearance it resembles *P. regius*, differing from this in its smaller scales, and more numerous dorsal rays. The greatest height is one-fifth of the total length to caudal base, and equals four-fifths of the length of head. Head 4 times in length to caudal base. Eye slightly less than snout, 5 times in length of head. Maxilla slightly less than mandible, one-half length of head. First dorsal not produced. Ventral about five-fourths length of head. Pectoral equal to head in length. Dorsal XIII, 57; Anal 49. Scales between first dorsal and lateral line in nine or ten rows; about 120 scales in the lateral line.

Ophichthys guttifer, new species.

The type of the species numbered 32,647 in the National Museum register is 22½ inches in length. It resembles *O. ocellatus* (Le Sueur) very closely, but the differences from that species are so important that we cannot consider them sexual.

The greatest height of body equals the distance from the angle of the mouth to the tip of the snout. The dorsal fin begins at a distance behind the vertical from tip of pectoral equal to length of the snout. The length of the pectoral is nearly 3½ times in length of the head. The head is ⅛ of the total length, ⅜ of the trunk. Eye 1½ times in length of snout, 9 times in that of head. Twenty-one or twenty-two small white spots along the median line.

A REVIEW OF THE AMERICAN CROSSBILLS (LOXIA) OF THE L. CURVIROSTRA TYPE.

By Robert Ridgway.

Read March 8, 1884, and published by permission of the Director of the U. S. National Museum.

Having long suspected the existence of two forms of the Red Crossbill in the United States, besides the Mexican race (*L. mexicana* Strickl.) which occurs just within our borders in Southern Arizona (and perhaps also in New Mexico), I was not surprised to find this conviction fully confirmed by a fine series of specimens presented to the National Museum by Captain Chas. E. Bendire, U. S. A., and obtained by him at Fort Klamath, Oregon, during the winter of 1882–83. The form under consideration being unquestionably distinct from both *L. americana* and *L. mexicana*, as well as from the several Palæarctic races, and being, so far as I am able to discover, unnamed, I take great pleasure in dedicating it to Captain Bendire as a slight recognition of his very valuable services to North American ornithology.

I am at present inclined to consider all the Red Crossbills that I have seen, from whatever country, as races of *Loxia curvirostra* Linn.; and therefore must prefer for the bird under consideration a trinomial designation, as follows:

Loxia curvirostra bendirei.

BENDIRE'S CROSSBILL.

Loxia americana (part) Baird, B. N. Am., 1858, 426.

Curvirostra americana (part) Cooper, Orn. Cal., i, 1870, 148.

Loxia curvirostra var. *americana* Hensh., Rep. Orn. Wheeler's Exp. 1873 (1874), 79 (Ft. Garland, Colorado).—(?) Bendire, Proc. Bost. Soc. N. H., xix, 1877, 116 (Camp Harney, Oregon, in winter).

Loxia curvirostra var. *mexicana* Ridgw., Bull. Essex Inst., v, Nov., 1873, 181, 189 (Colorado).

Loxia curvirostra mexicana Minot, Bull. Nutt. Orn. Club, v, 1880, 229 (Colorado).

Loxia curvirostra bendirei Ridgw., MS.

HABITAT.—Chiefly the western mountain regions of the United States, from Colorado to Oregon and California; in winter, not uncommon in Eastern United States (Massachusetts, Maryland, etc).

SUBSPECIFIC CHARACTERS.—Differing from *L. curvirostra americana* in decidedly larger size. ♂: wing, 3.55–3.80 (average, 3.68); tail, 2.20–2.45 (2.34); culmen, .65–.78 (.71); depth of bill, .40–.45 (.42); gonys, .42–.50 (.47); tarsus, .62–.72 (.67); middle toe, .50–.60 (.57). ♀: wing, 3.40–3.60 (3.50); tail, 2.20–2.30 (2.23); culmen, .65–.70 (.67); depth of bill, .35–.40 (.39); gonys, .40–.55 (.46); tarsus, .60–.69 (.66); middle toe, .55–.58 (.56).

This race is about as much smaller than *L. curvirostra mexicana* as it is larger than *americana*. In fact, it may be considered as being about intermediate, so far as size is concerned. Compared with the *L. curvirostra*, it is found to differ in the following respects: (1) much brighter coloration; (2) shorter wing and tail; (3) shorter culmen combined with longer gonys, the mandible being proportionally stronger; and (4) more slender bill. *L. curvirostra mexicana* has the mandible still stouter, compared with the maxilla, and is, besides, much larger in all its measurements.

There is so little uniformity in coloration in the various races of this species that color alone is of little value as a race character. In the series of the present form, upon which these remarks are based, there are specimens which agree minutely in colors with examples of both *mexicana* and *americana*. In fact, it seems that *full-plumaged* specimens of the three American races are constantly much brighter than the two European forms (*L. curvirostra* and *L. curvirostra pityopsittacus*), although it should be stated that, with one exception, the males of the latter which have been examined are mounted museum specimens, and possibly much faded. However this may be, they certainly do not approach in richness of plumage American specimens of average intensity of coloration. There are two specimens, however, in the series before me which differ considerably from others in the tint of the red, which, on the lower parts, is of a

purplish cast, much like a dilute tint of "Ruben's madder," the middle of the belly and the anal region fading into white. These specimens are Nos. 94,877 and 94,887, from Fort Klamath, Oregon, December 11, 1882, (Capt. Bendire, coll.), and resemble so closely two adult males from northern Japan (Nos. 91,432 and 91,433, Tate-Yama, P. L. Jouy, coll.), as to be distinguished only with great difficulty. Taking, however, No. 94,877, in which the resemblance to the Japanese birds is closest, and comparing with both the latter, the following differences are observable: The upper parts are decidedly darker, the pileum in the Japanese specimens being of the same pale purplish red as the color of the breast, while the brighter color of the rump corresponds closely to that of the flanks. In the Fort Klamath specimen, on the other hand, the pileum is much darker than the breast (being nearly the same color as the back), while the red of the rump is very much more intense than that on the flanks.

Three females from Japan are, however, practically indistinguishable from as many of the same sex from eastern Oregon (Fort Klamath, December, 1882, Capt. Bendire). In fact, were it not for the difference of habitat, these female Japanese Crossbills might well be regarded as identical with the larger North American form.*

*The Japanese Crossbill has been referred to *L. albiventris* Swinhoe, but the description (Proc. Zoöl. Soc. Lond., 1870, p. 437) indicates a bird "like in color to *L. curvirostra*, but differing from all the known species in having the abdomen and under tail-coverts white, the latter with large central arrow-head brown spots. Under quills, whitish. Length 6 inches; wing $3\frac{5}{8}$; tail 2; tip of wing to end of tail, 6. Iris brown; bill brown, light horn-color along the tomia. Legs, toes, and claws blackish brown, washed with pink on the soles." Habitat, southeastern China. Should the phrase "like in color to *L. curvirostra*" be correct, the Crossbill of middle Japan certainly is not identical with that of China, for the Japanese specimens, both male and female, which I have examined are far more like *L. curvirostra bendirei* than *L. curvirostra* (*vera*). At any rate, even should they prove on comparison to be the same, the name *L. albiventris* is pre-occupied, having been bestowed in 1804 by Hermann (Obs. Zool., p. 205) upon a species of *Munia*. Regarding the Japanese birds as distinct from *L. curvirostra* proper (and leaving the question of their relationship to the Chinese bird in abeyance), it becomes necessary to give them a new name. I therefore propose to call them—

Loxia curvirostra japonica NOBIS. SUBSPECIFIC CHARACTERS.—Differing

In connection with the present subject, some remarks upon the other races of *L. curvirostra* (or supposed to be referable to that species) may not be unacceptable, the observations in question being based chiefly on specimens contained in the National Museum collection.

L. curvirostra pityopsittacus.—There are before me two adult males and one adult female of this robust species or race. These resemble most nearly, among the American forms, *L. mexicana*, but are decidedly larger in all their measurements, the bill especially being much higher; the mandible is broader at the base, though proportionally much shorter. The colors are similar but not so bright. The measurements of this form, as compared with *L. mexicana* and *L. curvirostra*, its nearest allies, are given in a table at the end of this article.

In Yarrell's "History of British Birds," fourth ed., part xi, page 210, the comparative measurements of *L. pityopsittacus* and *L. curvirostra*, apparently quoted from Dresser's "Birds of Europe," are given, in substance, as follows:

	Total length.	Wing.	Tail.	Tarsus.	Culmen.	Height of bill at base.	Width of mandible.
L. pityopsittacus	6.30–7.00	4.00–4.30	2.70–2.80	.75	.90	.60	.50
L. curvirostra	5.70–6.00	3.70–3.90	2.50–2.70	.60–.65	.75–.85	.50	.37–.40

from *L. curvirostra* (*vera*) in having the red of a fine rosy or madder-lake tint, the dimensions somewhat smaller. Female much grayer than that of *curvirostra*. *Dimensions.*—♂: wing 3.60–380 (3.70); tail 2.30–2.40 (2.35); culmen .70; depth of bill .45–.48 (.46); gonys .45–.48 (.46); tarsus .65–.70 (.67); middle toe .60. ♀: wing 3.60–3.70 (3.66); tail 2.20–2.35 (2.28); culmen .68–.70 (.69); depth of bill .42–.45 (.44); gonys .45–.49 (.46); tarsus .65–.70 (.68); middle toe .57–.58.

NOTE.—Since the above was written, specimens of a red crossbill have been received at the National Museum from Hakodadi (Nos. 91,386, ♂ ad., Feb., and 91,387, ♀ ad., Feb.), which are in every respect similar to European examples of *L. curvirostra*. It would therefore appear that while the form inhabiting the middle or main island of Japan is a distinct local race, that found in the northern island is identical with the European race.

L. curvirostra (*vera*).—Of this species or race I have for comparison only three adult males and two adult females. There is not the slightest difficulty in distinguishing any of these examples from *L. pityopsittacus*, or from any of the numerous American specimens. As to the latter, the resemblance of *L. curvirostra* is far nearest to *L. mexicana;* but the latter has a much more intensely red coloration, has the wing and tail (on the average) decidedly longer, and the mandible decidedly longer and stouter, both absolutely and in proportion to the upper mandible.

L. curvirostra americana.—When Wilson characterized his "*Curvirostra americana*," he thus separated a North American Crossbill differing from the common European species (*L. curvirostra*), among other characters, in "being nearly one-third less." This statement of the difference in size is certainly not exaggerated. Of this form—which is the prevailing one in northern and eastern North America—I have examined in this connection twenty-four males, and twenty-three females. The characters presented by this series are very uniform, scarcely a single specimen being sufficiently larger than the average to render its position doubtful.

Compared with the provokingly small series of *L. pityopsittacus* and *L. curvirostra* which is available for the purpose, all the full-plumaged males of *L. americana* are decidedly brighter in coloration.* There is, however, much individual variation in color.

The brightest colored examples are Nos. 83,368, District of Columbia (spring of 1864; C. Drexler), and 78,186, Santa Cruz, California (W. A. Cooper), which are much alike, except that the former has the centre of the abdomen, hinder flanks, and anal region a rather deep, dull, grayish brown tinged with red, whereas in the latter these parts are dull grayish white. Both have the red of a deep "dragon's-blood" tint above, deepening on the head into a tint intermediate between "Indian-red" and crimson (but

* It is true that this is directly contrary to the experience of Messrs. Sharpe and Dresser, who state (Birds of Europe, pt. xiv) that "the adult male is generally duller than *L. curvirostra*, the red approaching to dirty orange;" but their observation was evidently based upon specimens not in perfect plumage.

much nearer the former), the rump much brighter, and inclining to clear, dull vermilion. The lower parts are bright "dragon's-blood-red," with a tinge of crimson. The wings are dark sepia-brown, the feathers very indistinctly edged with dull reddish-brown.

No. 83,366, from Utica, New York (winter of 1869; J. Davis), is very similar, but the red is somewhat lighter, inclining more to a dull vermilion shade. The centre of the abdomen adjoining the anal region is dull grayish white.

The darkest colored example is No. 86,893, Garrison's, New York (Dec. 30, 1874; T. Roosevelt), in which the red is of a dark madder-brown cast, the rump more brilliant, or of a dark brownish vermilion tint. The wings and tail are uniform dark sepia, without reddish edgings; the scapulars uniform dark sepia, and the back similar, but strongly tinged with dark red.

No. 93,630, from Arizona, has the red very brilliant, the whole pileum and nape, rump and lower parts being dull scarlet.

There is, in fact, so much individual variation in color that scarcely two specimens are closely alike.

The following measurements represent the averages of all the adult specimens of the several races which I have been able to examine. The males and females are given separately; and it will be noticed that *pityopsittacus* and *americana* represent the extremes of size, the others being intermediate in the order given. *L. himalayana* Hodgs. is said to be smaller than *americana*, but I have seen no specimens.

Males.

	Wing.	Tail	Culmen.	Gonys.	Depth of bill.	Tarsus.	Mid. toe.	Number of specimens.
L. pityopsittacus	4.10	2.60	.92	.60	.60	.75	------	2
" mexicana	3.99	2.54	.78	.53	.49	.70	.63	8
" curvirostra	3.88	2.48	.79	.46	.48	.68	.55	3
" japonica	3.70	2.35	.70	.46	.46	.67	.60	2
" bendirei	3.68	2.34	.71	.47	.42	.67	.57	21
" americana	3.38	2.12	.60	.41	.35	.62	.53	24

Females.

L. pityopsittacus	3.90	2.60	.75	.50	.58	------	------	1
" mexicana	------	------	------	------	------	------	------	(None.)
" curvirostra	3.75	2.35	.71	.49	.45	.70	------	2
" japonica	3.66	2.28	.68	.46	.44	.68	.57	3
" bendirei	3.50	2.23	.67	.46	.39	.66	.56	11
" americana	3.31	2.08	.59	.44	.37	.63	.52	23

NOTE.—Since the above was written, Mr. Wm. Palmer has kindly loaned me for examination three adult males and two females, obtained at Escanaba, Michigan, in June, 1883. These all belong to *americana*, and doubtless represent the form which breeds in that region.

NOTE ON THE ANAS HYPERBOREUS, PALL., AND ANSER ALBATUS, CASS.

BY ROBERT RIDGWAY.

(Read March 8, 1884.)

While there can be no doubt that Mr. Cassin did right in separating the smaller North American Snow Geese from the larger ones, it is very evident that he committed an error in giving the smaller form a new name. Pallas's *Anas hyperboreus* was based upon the birds of this species occurring in eastern Siberia; and on referring to his description it is perfectly clear that the Siberian specimens are identical with those from Alaska and other western portions of North America, which represent the so-called "*A. albatus*" of Cassin. This smaller form of the Snow Goose is not only the typical race, but has by far the most extensive distribution, so far, at least, as the United States are concerned, and is decidedly the more common one in most collections.* The larger race is the *Anas nivalis* of Forster (Philos. Trans., lxii, 1772, p. 413), and may therefore be called *Chen* (or *Anser*) *hyperboreus nivalis* (FORST). The habitat of this large race is the region about Hudson's Bay (the breeding grounds unknown, however), and southward in winter chiefly along the Atlantic coast of the United

* The National Museum possesses only three specimens of the larger form, but has received at least ten times that number of the smaller race.

States. The smaller form, or true *hyperboreus*, breeds along the arctic coast, from northern Alaska eastward for an undetermined distance, but at least to the mouth of the McKenzie river; and throughout this extent of coast-line, and thence southward over the whole western portion of the continent, entirely replaces the larger bird.

As to the distinctive characters of the two races, I would remark that, while the length of the wing is by no means decisive (the maximum of *hyperboreus* being about 17.50 inches, and the minimum of *nivalis* 17.00!), *nivalis* always has a much larger bill, the culmen in adults of this form measuring from 2.50 to 2.65, and the length of the bill from tip to point of the basal angles, 3.00 to 3.12, the corresponding measurements of *hyperboreus* being only 1.95 to 2.28 and 2.50, or less, to 2.75.

REMARKS ON THE TYPE SPECIMENS OF MUSCICAPA FULVIFRONS, GIRAUD, AND MITREPHORUS PALLESCENS, COUES.

By Robert Ridgway.

(Read March 8, 1884.)

In the "Nomenclature of North American Birds" (p. 32, Nos. 329 and 329*a*), I have included, as two races of one species, an "*Empidonax fulvifrons* (Giraud) Scl.," and an *E. fulvifrons pallescens* Coues." This I did under the impression, based upon previous examination of the type specimens, that they were in reality sufficiently distinct to justify subspecific separation. Having recently had the matter brought to mind in another connection, I have re-examined the types in question, together with other material, and have thereby come to the following conclusions: (1) that *E. pallescens* is a decidedly smaller, lighter, or grayer colored western race, restricted to the western side of the Rocky Mountains, in Arizona and New Mexico, and probably portions of western Mexico also, although I have not seen specimens from

south of the United States boundary; (2) that *E. fulvifrons* proper belongs to the country on the eastern side of the Rocky Mountains, the National Museum possessing the original type specimen, stated by Giraud to have come from Texas; (3) that in southern Mexico a third race exists, which agrees with *pallescens* in smaller size, but differs in decidedly deeper, richer coloration. The latter is the *Empidonax rubicundus* CAB. (Mus. Hein., ii, p. 70), but, being unquestionably conspecific with *E. fulvifrons*, should, in accordance with more modern usage, be called *E. fulvifrons rubicundus* (Cab.). We have, therefore, three geographical races of this species: the typical *fulvifrons* (Gir.) of "Texas" (and probably northeastern Mexico also), the *E. fulvifrons rubicundus* (Cab.) of southern Mexico, and *E. fulvifrons pallescens* (Coues) of southern Arizona and western New Mexico, and, probably, western Mexico.

I subjoin measurements of the adult specimens now before me, including two (from El Moro, New Mexico) which have the plumage much abraded.

a. E. fulvifrons (Giraud).

			Wing.	Tail.	Culmen.	Tarsus.	Mid. toe.
47691	—ad.	"Texas"	2.70	2.45	.35	.21	.60*

* Type of the species.

b. E. fulvifrons pallescens (Coues).

40601	♂ ad.	Ft. Whipple, Ariz.	2.20	1.95	.35	.20	.52*
40602	♂♀ "	" "	2.25	2.00	.37	.22	.51†
------	♂♀ "	Apache, Ariz.	2.40	2.10	.37	.20	.55
68603	♂♀ "	El Moro, New Mex.	2.45	2.10	.38	.20	.60
68604	♂ "	" "	2.40	2.15	.35	.21	.55

* Type of *Mitrephorus pallescens* Coues.

† *Ibid.*

c. E. fulvifrons rubicundus (Cab).

32914	♂ad.	"Mexique" ----------	2.35	1.90	.37	.20	.52

It may be seen from the above measurements that there is much variation in dimensions in *E. fulvifrons pallescens*, from which we may reasonably infer that the same would be the case in the other races were an equal number of specimens measured. The coloration, however, is very uniform, none of the specimens of *pallescens* (and there are several young birds which are not measured) showing any approach to either *fulvifrons* or *rubicundus*.*

True *E. fulvifrons* is of a peculiar shade of dull ochraceous-buff beneath, the throat and belly slightly paler, but not at all inclining to white; the upper parts are light dull brown, very slightly darker and duller on the pileum and lighter on the rump. *E. pallescens* is light yellowish ochraceous on the breast and sides, with the throat and belly inclining to yellowish white, and the upper parts are decidedly grayer than in *fulvifrons*. *E. rubicundus* is bright ochraceous beneath, the belly light creamy yellow, the throat buffy whitish, and the upper parts decidedly fulvous-brown.

NOTE REGARDING THE EARLIEST NAME FOR CARPODACUS HÆMORRHOUS (WAGLER).

By Robert Ridgway.

(Read March 8, 1884.)

A reference to plate 386 of Buffon's "Planches Enluminures" shows that figure 1 depicted thereon is intended to represent an adult male of the Mexican House Finch in abnormal plumage, or having the usual red color replaced by yellow—a variation not

* An additional series from New Mexico and Arizona, which, through the courtesy of Mr. H. W. Henshaw, I have recently been permitted to examine, fully confirms the validity of *pallescens*, none of the twelve specimens showing a nearer approach to *fulvifrons* than is exhibited by the specimens previously inspected.

uncommon among caged birds of this and allied species, and sometimes seen in wild specimens. This figure is the basis of *Fringilla mexicana* MÜLLER (Syst. Nat. Suppl., 1776, p. 165), and also of *Emberiza mexicana* BODD. (Tabl. P. E., 1783, p. 23). This bird must, therefore, be called *Carpodacus mexicanus* (Müll.), or, should intergradation with *C. frontalis* be proven, *C. frontalis mexicanus* (Müll.).

ON SOME HYDROCORALLINÆ FROM ALASKA AND CALIFORNIA.

By W. H. Dall.

(Read March 22, 1884.)

The descriptions herewith, with one exception, are of species from an area from which none have hitherto been described.* They are closely allied to species found in the Oregonian and Californian province described by Prof. Verrill, but have been, by his kind assistance, compared with his types, and appear to him and to myself to be distinct species, differing not only in habit and form, as well as relative size of the calyces, but especially in the sculpture and texture of the surface of the corallum. It is quite probable that the other species may hereafter be found in southeastern Alaska, in which case the fauna would comprise—

Allopora venusta Verrill; *Allopora Verrillii* Dall; *Allopora californica* Verrill; *Allopora Moseleyi* Dall; *Allopora papillosa* Dall.

To complete the list of Alaskan coralloid animals, *Calligorgia compressa* of Verrill may be added, as found in the Aleutian Islands, the only representative of the sea-fans yet known from the region, which is, however, extremely rich in Sertularian hydroids.

Allopora Verrillii, n. s.

Cœnosteum thin, reptate, whitish to pale rose pink, solid, encrusting; with a smoothish irregularly lumpy surface pretty regu-

---

*A *Stylaster rosso-americanus* Brandt has been mentioned (Z. Wiss. Zool., xxii, 292), but has never been described or figured. It may be an additional species.

larly dotted with sporadic calyces, composed of circular gastropores, each surrounded by a circle of five to nine dactylopores, with occasional sac-shaped ampullæ, which are most abundant on the most elevated projections of the surface, and almost entirely absent from depressed parts. Diameter of the dactyloporic circle about 1.0^{mm}.; of the central gastropore about 0.37^{mm}.; the distance from center to center of the calyces varies from 1.5 to 2.5^{mm}.

Gastropores, cup-shaped, shallow (0.25–0.50^{mm}.), smooth inside, with the tip of a white spiculose nipple-shaped, or roundly conical style in the bottom of each, projecting about its own diameter or less into the cup through the aperture of a long nearly vertical conical tube which it occupies and closely fills. The length of this style, which resembles a fox's brush, is nearly equal to the thickness of the cœnosteum. The margin of the cup in fully developed gastropores is simple and entire, and depressed slightly below (or in no case elevated above) the general surface. In immature calyces there is frequently a shallow groove running from the innermost point of each dactylopore toward or into the gastropore.

Dactylopores variable in number, eight seeming to be the normal, but seven the most common number, never sporadic, in well-developed calyces entirely separated from the cavity of the gastropore throughout their extent; in immature ones joined to it by a shallow superficial groove. Transverse section a little ovoid, the wider arch away from the gastropore, and marked by a vertical, narrow, spongy lamina forming the style.. The exterior margin simple, not elevated above the general surface, but rather slightly depressed below it. Neither sort of pore shows tabulæ. Ampullæ, simple sac-shaped cavities as large as, or larger than, the calyces, not protruding above the general surface, but more numerous on the prominences of the crust.

General surface between the above-described openings impervious, nearly smooth, with the vermicular fine reticulations of the cœnosteum structure showing through the translucent substance, and giving the surface a granular look, a vertical section of the crust

looking much the same. Soft parts unknown. Crust growing several inches in diameter, and rarely more than three-eighths of an inch in thickness, generally found on dead shells of Modiola or pieces of nullipore from deep water. Habitat: thrown up on beach of Chika Islands, Akutan Pass, Aleutian Islands, near Unalashka—five specimens collected May, 1872, by W. H. Dall. Catalogue number, U. S. Nat. Museum, 4193.

Allopora Moseleyi, n. s.

Cœnosteum thick, nodulous or indistinctly branched, rosy pink, solid, with an irregular vesicular surface with sporadically distributed protuberant calyces, consisting of subcircular gastropores deeply vertically grooved near their margins by seven to twelve dactylopores whose cavities are continuous with the cavity of the gastropore. Ampullæ not observed. Diameter of the dactyloporic circle about 1.5^{mm}.; of the gastropore proper 0.75^{mm}. Gastropores rather deeply (0.50–0.75^{mm}.) cup-shaped, with the inner surface spiculose; style as in the preceding; margin of the pore deeply indented by the dactylopores, which are usually nine in number, but appear to be normally twelve; the whole calyx projecting, nipple-like, about 0.5–0 6^{mm}. from the general surface; recalling, in form, a small contracted *Zoanthus*. A spiculose lamellar style appears in the depth of each dactyloporic groove on careful search. The grooves appear to remain always open.

General surface impervious, covered between the raised calyces by small irregular sparse vesicular projections of the cœnosteum, otherwise in appearance and compactness much as in the previously mentioned form. Soft parts unknown. Habitat: Kyska Harbor, Kyska Island, in the western Aleutians, one specimen on the beach growing in a cavity between the layers of a mass of nullipore, collected July, 1873, by W. H. Dall. Museum number, 6851.

Allopora papillosa, n. s.

Cœnosteum very thin, encrusting, livid madder-pink or brown, with a regularly papillose surface, with close set sporadic calyces

composed of deep cylindrical gastropores vertically grooved for three to six dactylopores, which are wholly continuous with the cavity of the gastropore. Ampullæ not noticed. Diameter of the calyx about 0.5mm., of the gastropore proper about 0.35mm.; average distance between the calyces, 0.7–1.3mm.

Gastropores deep, cylindrical, with a short, hardly perceptible style, which comes into the bottom of the gastropore, but, as a vertical section shows, not vertically but obliquely from one side. Inner surface nearly smooth, a narrow elevated ridge bounding the margin of the combined gastropores and dactylopores.

Dactyloporic grooves rather shallow, long, each with an evanescent trace of a style on the outer wall; six seems to be the normal number to each calyx.

General surface spiculose or finely granulated with small, pointed granules, with regularly-shaped, elevated, uniform papillæ standing in the spaces between the pore margins, and rising to about the same height, but absent on the immature growing margin of the colony.

Cœnosteum less vesicular than in the previously-described forms. Soft parts unknown. Habitat: on the outside of a living *Mytilus californianus*, from six fathoms, Coal Harbor, Unga Island, Shumagin Islands; collected October, 1874, by W. H. Dall. Museum number, 6852.

Errina Pourtalesii, n. s.

Cœnosteum of a saccharine structure, rising in stout, subcylindrical, rather round-pointed, occasionally branching stems ten to fifty millimeters high (possibly much larger at times), and eight or more in diameter; color, when fresh, deep rose-red, bleaching to white or gray in dead specimens; surface loosely granular, becoming lighter colored and more compact inward toward the central axis; gastropores disposed in irregular lines, which, in the specimen in hand, have a tendency to run from the base spirally to the left, around the column, but are so crowded that little of the surface is free from the nariform hoods of the attendant dactylopores; the

gastropores average 0.25mm. apart, but are rather irregular and occasionally sporadic, a rounded, rather smooth-topped style fills the pore nearly to the brim; the dactylopores are arranged alternately on opposite sides of the row of gastropores opposite the intervals between the latter, though sometimes crowded out of regularity; they are furnished with subtubular projections, squarely truncated at the top and open toward the gastropores, rising above the general surface to about 0.5mm. or more; when perfect the styles rise nearly to the summit of the enclosing hood, slender, pointed, and rather feathery; two-thirds of their length, in general, is above the surface, and the depth of the gastropores is seldom greater (as a rule less) than that of the submerged portion of the others. Ampullæ on the surface, barely covered by a net-work of cœnosteal granules, which are often broken away, leaving shallow open cups between the projecting hoods; there are no scales, and the circular margin of the gastropores is smooth and simple.

Soft parts unknown.

Habitat: in 50–100 fathoms about the Farallones Islands, off the coast of California, on stones which are frequently brought up on the fishermen's hooks entangled in the corals. A large stone with several specimens upon it was obtained by Count Pourtalès in 1873, and is now in the Museum of Comparative Zoölogy, at Cambridge, from which the specimen described was selected; other specimens are in the collection of the California Academy of Sciences. This coral, as well as *Allopora venusta* and *A. californica* Verrill, meet with a ready sale in San Francisco, owing to their beautiful color, which, however, is not lasting if the specimens be much exposed to the light. The present species seems to do a good deal toward bridging the gap between *Errina* and *Distichopora*, as defined by Moseley. Museum number, 6853.

I may add, in conclusion, that through the kind co-operation of Prof. G. O. Sars and Miss Birgithe Esmark, I have been enabled to compare the Alaskan and Norwegian Alloporas, which, however, do not present any very marked points of resemblance outside of the generic characters.

SOME RESULTS BY MASSAGE ET CONTRE-COUP.

By W. S. Barnard, Ph. D.

Abstract of a communication made December 28th, 1883.

The application of jarring, somewhat stunning, blows in exceedingly rapid succession through a cushioned or elastic medium, to the head in particular directions at certain points of the cranium and face have been found in my experimentation to be simple means of producing local effects on the brain for the treatment of impaired circulation causing headache, &c.; also touches of what I denominate mechanical anæsthesia, and mechanical ataxy of local and transient character were similarly obtained. By making the blows very rapidly and through the deadening medium, they need not be so hard as would be the force of a single blow strong enough to cause a stunning effect, and the continuance of the effect is gained by the repetition of strokes in rapid succession. The fleshy portion of the hand was used for applying the strokes, and any elastic pounder answers. The speaker has been stunned by a single blow from a rubber ball, and quickly regained his senses without any noteworthy suffering, and has witnessed like cases of stunning with little pain from single strokes by boxing gloves. Similar examples, not uncommon, sustain the reality of mechanical anæsthesia and mechanical ataxy. By applying the rapid blows to parts of the head, temporary locomotor ataxy was experimentally generated while walking. The blows repeated as rapidly as possible are made harder and harder until with sufficient force shown by the effects instantly resulting as follows, but the blows must be hard enough to overcome voluntary effort; their application in a crosswise direction against the side of the chin caused turning and falling toward the blows, but similarly applied on the same side against the cranium at a region far backward but upward from the ear caused fall-

ing and turning in a contrary manner toward the opposite side. The blows against the chin on one side yielded the same effect as if against the occiput on the other side. The transmission of violence from one side of the chin to the opposite side of the upper back portion of the brain was named and explained as rotary transmission and delivery, viewing the head mechanically as a two-armed hollow lever and as an irregular wheel on the vertebral axis, the chin terminating one lever arm while the brain is contained in the other arm, the seat of locomotor control being in that part of the brain which is in the lever end farthest from the chin, as indicated in sketches shown. The effect there on one side of the brain inhibited the use of the leg of the opposite side, &c. Some contre-coup injuries were similarly explained. The importance of the study of these and certain related principles, their application, and the practice of jarring to produce deep effects in the treatment of head maladies was urged.

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